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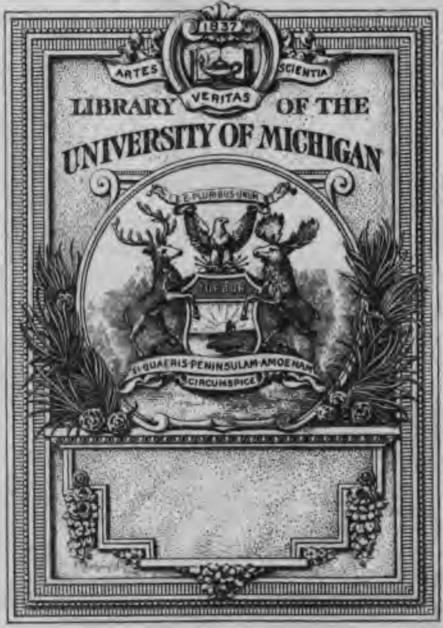
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MEMORIAL

OF THE OFFICERS OF THE

CORPS OF ENGINEERS

OF THE UNITED STATES NAVY,

ADDRESSED TO THE

CONGRESS OF THE UNITED STATES,

IN SUPPORT OF THE

BILL NOW PENDING BEFORE IT CONFERRING
ABSOLUTE RANK, AND THE TITLE OF THAT
RANK, ON THESE OFFICERS.

WASHINGTON:
Thomas McGill & Co., Law Printers, 1107 *E Street Northwest.*
1879.

Memorial of the Officers of the Corps of Engineers of the United States Navy, addressed to the Congress of the United States, in support of the Bill now pending before it conferring absolute rank, and the title of that rank, on these Officers.

We have the honor to submit to the two Houses of the Congress of the United States the following memorial, embodying a statement of the present status of the officers of the Engineer Corps, in regard to rank and title, and the considerations which induce them to ask from Congress such legislation as will fix their rank and titles in a satisfactory manner.

The present statute fixing the relative rank of the officers of the Engineer Corps of the Navy is section 1476 of the Revised Statutes, and the effect of this section is simply to give officers of this Corps *relative* rank in regard to the officers of the Line of the Navy, as though the Engineer Officers of the Navy were not a portion of the Navy, but a distinct and separate service. The actual rank of the Line Officers of the Navy is conferred by section 1362, Revised Statutes, and the contrasting of the wording of the two sections will show that section 1362 bestows actual rank, while section 1476 only gives relative or nominal rank. To illustrate this point, then, it may be stated that the Line Officers of the Navy have *relative* rank with the officers of the Army, and the officers of the Army have *relative* rank with the Line Officers of the Navy. The Army and Navy being distinct and separate services, having no connection with each other and different titles for substantially the same rank, this kind of relative rank was necessary to show how the officers of one service stood in rank or position relatively to the officers of the other service, and is of use in matters of mere ceremonial only. The Navy Officer is never commanded by the Army Officer, nor the Army Officer by the Navy Officer; so that the only occasion in which a question of precedence can arise between them is that of ceremonial.

But as regards the Line Officers and the Engineer Officers of the Navy, the case is entirely different, as both belong to one service and are on duty together. Their official action cannot be separated; they serve in the same navy-yards, in the same vessels of war, and their joint action is for the consummation of the same purpose; they are inseparably one, as regards their naval duties, just as the various grades or ranks of Line Officers serving on board the same vessels are one and inseparable; so that no reason exists for any *relative* rank between them, and indeed the term, as applied to the rank of the Engineer Officers of the Navy, is an absurdity. Rank is essential to the proper performance of their duties. That is conceded by all; but it must be the same *kind* of rank, or how can it have comparison? The whole difficulty of the position and the necessity for reformation in this matter is from the heterogeneousness of the present rank in the Navy, one part having absolute and the other part having relative rank. This can only be remedied by making the rank homogeneous, or of the same *kind* throughout, which is the purpose of the accompanying bill. The concession that rank is essential to the Engineer Officers of the Navy for the proper performance of their duties, was extorted by the necessities of the case; but to make the concession as little as possible, it was made a *quasi*-rank, with the undefined term "relative," about which no satisfactory construction has ever been made or can be made. Two things wholly differing in nature cannot be made the same in their effect.

What is particularly desired to be impressed is, that relative rank is only proper between officers of totally different services, such as Army and Navy, for example, but that it has and can have no application between officers of the same service.

This principle is recognized to the completest extent in the Army, all the Corps of which, without exception, have the same ranks and military or Army titles. The officers of the Ordnance Corps of the Army have no *relative* rank with the officers of the Infantry Corps; and the Engineer Officers of the Army have no *relative* rank with those of the Artillery Corps, and so on; the rank is absolutely the same for all in each Corps, and the titles of the rank are the same also. This system produces perfect harmony of feeling, concert of organization, and efficiency in action; and is what should be adopted in the Navy to produce the same desirable results. Section 1556 of the Revised Statutes fixes the pay of the Engineer Officers of the Navy, and is substantially that of the Officers of the Line having the same rank and length of service. The *value* of the services of both is considered equal.

The parallelism between the duties of the Engineer Officers of the Army and of the Engineer Officers of the Navy is as complete as the difference of the services will admit. The duties of both corps are essentially *designing* and *constructing*. The Naval Engineers design and construct iron ships, and steam and other machinery of every kind used in the Engineer department of the navy-yards and in the steamers of the Navy. Their education and practice is for the designing and manufacturing of all tools and appliances used for the construction of iron ships, iron-clads, and the various adaptations of steam machinery for propulsion and other purposes on board naval steamers. The Army Engineers design and superintend the construction of fortifications. (Revised Statutes, section 1153.) They regulate and determine the number, quality, form, and dimensions of the necessary vehicles, pontoons, tools, implements, arms, and other supplies for the use of the Engineer battalion. (Revised Statutes, section 1152.)

Section 1158 of the Revised Statutes prescribes that Army Engineers shall not assume nor be ordered on any duty beyond the line of their immediate profession.

Revised Statutes, section 4653, prescribes that two officers of the Engineer Corps of the Army shall serve on the Light-House Board, and to these two is given the entire designing and constructing of the light-houses, light-vessels, &c., of the United States. (Revised Statutes, section 4664.) All plans, drawings, specifications, estimates of cost of all illuminating and other apparatus, and of construction and repair of towers, buildings, &c., connected with the light-house establishment are to be prepared by the Engineer Secretary of the Light-House Board, or by such officer of Army Engineers of the ~~Navy~~ as may be detailed for that service. (Revised Statutes, section 4665.) In a word, the Engineer Officers of the Army are the mechanical officers of the Army, as the Engineer Officers of the Navy are the mechanical officers of the Navy, each designing and superintending the particular mechanical work of their respective departments.

Now, the Engineer Officers of the Army have the same rank and titles as the Army Officers of the Line, (Revised Statutes, sec. 1151,) with the addition of the name of the Corps. The Army Engineer is a Colonel or a Major of Engineers, as a Line Officer is a Colonel or Major of Infantry, of Cavalry, &c., and so far from the same rank and titles causing confusion, they are the means, and the only ones, that can produce order and regularity, and prevent any clashing of claims or pretensions.

The bill now pending before Congress for the Naval Engineers is intended to give them exactly the position in the Navy which the Army Engineers have in the Army, both as regards rank and title. It is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the

Officers of the Corps of Engineers of the United States Navy shall have positive rank, and the title of that rank corresponding to the relative rank they now hold by law, in lieu of their present titles; and promotions in the Corps of Engineers from and above the rank of Lieutenant shall be by seniority; and the President is hereby authorized to issue the new commissions required by this act: *Provided*, That nothing contained herein shall be construed to alter the laws regulating the present ~~present~~ pay of the Corps of Engineers, nor to give the officers of that corps any additional right to quarters, nor to confer on them any authority to exercise military command.

In support of the pending bill before Congress to give the Engineer Officers of the Navy the proper naval title of the relative rank they now hold by law, and to make that rank absolute, the following considerations are respectfully submitted. They by no means exhaust the arguments which could be adduced, but it is believed they are sufficient to establish the propriety and justice of the provisions of the bill, and to show that the public service will be benefited thereby.

Since steam machinery was first introduced into the navies of the world, about forty years ago, as an auxiliary to sails, its employment being restricted to calms and to entering and leaving port with a speed of five miles per hour, its use has gradually extended until at the present time it is *the marine motor*, while sails have continually dwindled until they are now merely an auxiliary to the machinery, being greatly reduced in extent and only set when the wind is fresh and fair, but no longer used for the sole propulsion of the vessel. Indeed, it would not be difficult to prove that their complete suppression would be profitable. The machinery, which at the first was small and simple, being barely sufficient for a speed of five miles per hour, has increased as the sails decreased, until it has become enormous in size, complexity, and power, giving speeds of twenty miles per hour. It is now employed for almost every operation on board a first-class naval steamer; it loads and trains the guns, weighs the anchor, and manœuvres what remains of sails. It both propels and fights the vessel, which without it would be a helpless hulk. This great change in the motive power of the vessel has effected as great a trnsformation in the vessel's form, which has steadily been lengthened for the reception of more and more powerful machinery, until proportions have been reached that renders manœuvring by sails alone impossible. The ancient slow-sailing man-of-war, with its clouds of snowy canvas, and whose type was a bowl, has been evolved into the modern fast steamer, with its clouds of black smoke, and whose type is a canoe.

The real navies of the world, however, that is to say, the truly military portion of them, comprising the vessels which are able to fight in line of battle, are composed exclusively of armored steamers, without even auxiliary sail power, and carrying guns behind their iron defenses so immense as to be manageable only by machinery. All the operations on board such vessels—and they alone are the real fighting material of any modern navy—are performed by machinery, and cannot be performed without it. All other kinds of vessel except iron-clads, belonging to navies, are mere appendages, and have no value militarily save as auxiliaries, such as dispatch vessels, torpedo boats, depredators on an enemy's commercial marine, &c.; the real military strength of any navy being measured simply by its iron-clads, which, it will be remembered, carry no sails and depend wholly on their machinery.

But the progress of the present wonderfully mechanical age has changed not only the motor of the vessel but its material also, wood having been as completely superseded by iron as the sails by steam machinery. The modern war steamer can be constructed properly of ~~wood~~ iron only, and for the iron-clad an iron hull is indispensable. Hence, a difference in the methods of construction has arisen for the hull, as well as a difference in the rigging, all having passed into engineering, leaving the ship carpenter, like the sailor officer who used his production, an obsolete figure, with only the prestige of the past remaining.

This enormous change, which has left scarcely anything of the previous, has been confined almost wholly to the material of the Navy; the original organization of the personnel continuing and projecting its shadow of a bygone system inharmoniously upon a totally altered present. Formerly, the indispensable persons of a naval vessel were the sailors and the sailor officers, the latter being at present generally but illogically known as Line Officers. Now the sailors have nearly disappeared with their sails and with their small guns, which they were able to work by hand, and with them has largely disappeared the exclusive importance of the sailor officers. The sails have been replaced by machinery, the sailors by the firemen and coal-heavers of the engineer department, and the sailor officers to a great extent by the Engineer Officers, on whom the management of the steam machinery and its maintenance in efficient condition wholly depends.

The machinery of a modern war steamer costs about one-third of the whole value of the vessel, and occupies about one-third of the space. It is very complex, constantly undergoing change, requires high scientific attainments to comprehend and design, and much practical experience to skillfully manage. The entire efficiency of the vessel depends upon it, and it is efficient just in proportion to the professional talents of its designers and the experienced skill of its managers, who, to manage it well, require to be able to design, modify, or wholly change it, according to circumstances of use or accident. It will thus be seen that the real efficiency of a navy depends primarily on its Engineer Officers, the men who design and erect the machinery, and manage and keep it in working condition after it is erected on board the vessel. It is they who really execute the orders of the Commanding Officer, for without them he could not give effect to his orders, and it is to their skill and energy that he must look for success.

In the past, the orders of the Commanding Officer were executed by subordinate sailor or Line Officers; but now these subordinates have become still more subordinate, and in an iron-clad (the only real naval vessel) have functions but a little removed from that of messengers between the Commanding and Engineer Officers. The vessel has her speed and mobility controlled by the engineers, who also load and train her guns, most of the technical work on board being performed by them.

In the origin of the application of steam machinery to naval vessels, the machinery was small, simple, and but rarely employed; the Engineers in the Navy were few, and their qualifications commensurate with their duties; but as the machinery became more and more powerful and complex, and more and more employed, the Engineers of necessity increased in numbers, in consequence and in qualifications, until in the iron-clad they have become, next to the Commanding Officer, the most important of the personnel of a really military Navy. Their efficiency is the efficiency of the Navy, for upon it as a foundation rests the efficiency of others; even as without an iron-clad a Commanding Officer would be useless, so without Engineers an iron-clad would have no value. The fundamental facts are, that the iron-clad, propelled and fought wholly by machinery, constitutes the only Navy in a military point of view; that, aside from the Commanding Officer, all the important functions are performed by Engineers, and all the technical work, without exception, is done by them, the maintenance of the vessel in a state of efficiency resting wholly on their skill and energy. Not only, therefore, are the immense sums expended to make and maintain these vessels depending for their useful application on the the Engineers of the Navy, but the political interests and honor of the country, so far as they can be subserved by a Navy, also depend primarily on them.

That these facts are well understood, but most inadequately appreciated, by both the Navy Department and Congress, is proven by such increased pay and position as have from time to time been accorded to the Naval Engineers. Their first appointment to Cadet Engineer is guarded by a rigorous examination, physically, morally, and educationally; and each promotion is dependent on examinations of increasing stringency. The professional qualifications demanded for graduation from the Naval Academy, where the Cadet Engineers are now educated, are equal to what is required in the Military Academy at West Point for the graduation of Engineer Officers of the Army, whose duties are as analogous as possible to those of the Naval Engineers, allowing for the difference of the services. The Cadet Engineer, unlike the cadet sailor officer, is not a political nominee; he owes everything to his qualifications alone; talent is the only rule of selection in his case, and neither social nor political influence intervenes to shelter him from the consequences of inferiority. As a result, the Engineer Corps of the Navy compares favorably with any Engineer Corps in the world, and as a *corps du génie* is not surpassed by any, if equalled by a few. Its former members can be found in the professorships of the best polytechnic schools of our country, and in the front ranks of its civil engineering; while Congress, in compliance with popular demand, has lately enacted that Naval Engineers can be detailed by the Navy Department for professorships in such colleges and higher institutions of education as may apply for their services. It is on this corps, specially educated in mathematical and physical science, and trained in their practical application to naval construction, that the country must depend for its Navy of the future.

The monitor iron-clad, which instantly revolutionized naval warfare and naval construction, and the swift unarmored cruiser for the destruction of an enemy's commerce, are the productions of Engineers, and they have been copied by all the navies of the world. It certainly needs no argument to prove that naval constructions, hulls and machinery, in their present state of complexity, can only be mastered, and successfully designed and executed, by a trained corps of specialists exclusively devoted to these difficult subjects. Nor do the duties of such a corps end there, for the proper management of enormous and complicated machinery, in order to obtain its full effect, requires great professional knowledge and experience. Good management is as important as good design, for without it the final purpose will fail and render all that preceded useless.

There certainly can be no error in assuming that the status of the officers of such a corps should not be inferior to the status of the officers of any other Naval Corps; and if such inferiority exist and is continued, there can be as little error in predicting that the best members of such a corps will be lost to it, and that it cannot be maintained at the necessary elevation of professional qualification. No really able man—such as the Government requires in its naval engineers—can or will submit to a position of inferiority. The position, in justice and in sound policy, should be equal to the requirements. This is not the case; and the bill now pending before Congress is designed to remove a powerful and needless cause of dissatisfaction, which works great evil to the naval service and really benefits none. The main provision of that bill, to which the other provisions are but logical appendages, is to confer on the Engineer Officers of the Navy absolute rank corresponding to the relative rank they now hold by law, and to give them the naval title of that rank. The bill does not ask for any additional rank, pay, or privilege to what they now have by law. It simply asks that their present rank be made such that no misunderstanding can arise about it;

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The monitor iron-clad, which instantly revolutionized by his authority, that is, subordinate to the Captain, being an agent for him. Admiral is an army title, being the Arabic term for General, and so on of the others, none of which has any professional connection with seamanship or a sailor's duties. The naval titles do not designate profession at all: they are simply the names of naval ranks, and are as appropriate to one Naval Corps as another. If rank is given it should be expressed in the proper words, about whose meaning and application there can be no question. It should not be a *quasi*-rank, but a complete one; and as, from the nature of things, there can be but one kind of rank for the entire Navy, it should be known by but one kind of name. Until this is done there can be no harmony between the different corps; no clearly-drawn definition of duties, position, or responsibility; but an incessant wrangle between illegal and arrogant assumption on the one side, and a right but unsupported resistance on the other, with the Navy Department uncertain in its variable decisions, owing to the looseness of the terms of the law.

The present state of things, as regards naval rank, is based on the assumption that there is only one kind of Naval Officer, namely, that of the Line,—a just assumption if applied to the days of Admiral Benbow and Commodore Trunnion, from which it has descended, and in which steam machinery, iron-clad steamers, immense guns, and all the wonderful creations of modern naval engineering were undreamt of, a man-of-war then consisting of a wooden shell, some canvas, and two or three rows of pop-guns; but an entirely false one when applied to the present time, in which naval engineering is in reality the Navy, so far as the construction and management of its material are concerned, and the Naval Engineers form a large and as essential a portion of its officer personnel as do the "Line" or sailor officers. In fact, the former can perform the duty of the latter, but the latter cannot perform the duty of the that it cannot be so defined away or construed as to practically reduce it to nothing; and that the rights and privileges to which it is entitled cannot be ignored on the plea that its qualifying term deprived it of force and application. Such things have been done, and will certainly be done again, under existing law, and have given rise to a widespread and deep-rooted dissatisfaction, working much injury to the public service. For years after its enactment, the present law was absolutely ignored, and only lately has a partial and hesitating enforcement been made. This was a great wrong, not only to individuals but to the public, and its correction is the purpose of the present bill, in which nothing is asked for the Engineers at the expense of others, but only what is justly their right, the granting of which would much benefit the Navy.

No one Naval Corps has any special right to the naval titles, which are not professional titles at all, but merely rank designations. The Engineers have, at present, only their professional titles, exactly what they would have in civil employments, where the question of rank has no existence; they have no naval title to mark their connection with that branch of the public service and their position in it. The "Line" or sailor officers of the Navy have, in civil employment, the professional titles of *masters* and *mates* of their respective vessels; but when militarily organized in a navy a distinction of rank became necessary, and the ranks had to have names by which they might be recognized. As, originally, the sailor officers were the only naval officers, they have come in time to look upon these names as peculiar to themselves—to their profession. A glance at the meaning of these titles—many of which, such as Captain, Lieutenant, &c., are common to Army as well as to Navy, and to many other organizations—will show they designate rank only, and not profession. Captain signifies merely the "head" or chief officer of any department, and Lieutenant signifies one acting in his place or

Finally, the issue may be briefly stated as follows:

The present organization of the Navy, as regards its personnel, is precisely that which has descended from the days when vessels were propelled by sails alone; when the hulls were of wood; when the guns were small; when all the work on board ship was performed by manual labor; when the only officers were the Line or sailor officers, and all the crew were common sailors. In those days gunnery was a small and simple matter, and the only important qualification needed in the sailor officer was seamanship, or, in other words, a knowledge of the trade of a common sailor; and it was possessed in the highest perfection by the rough, ignorant, and brutal masters and mates of the then merchant marine.

At the present time, the true naval fighting vessel may be said to be propelled by machinery alone; its hull is of iron and has a form and construction totally different from the old wooden sailing hull, besides being defended by an armor of massive iron; the guns are enormous in size, and they are loaded and trained by machinery, which is likewise employed for nearly all the other operations formerly performed by hand. There being little or no occasion for seamanship—the peculiar knowledge of the sailor officers—very little, or nothing, of that trade remains, and the part of the crew still called "sailor," are the mere simulacra of their vigorous predecessors.

Had it not been for the very natural prejudices of the sailor officers for the rigging, tar, and canvas of their own profession, sails would long since have been as obsolete in the steamers of the Navy as in those of the merchant marine. Their retention for so many years after their usefulness was past, has been a source of great loss to the country; it has, in fact, so much retarded progress that the Navy does not, at this moment, contain a single vessel fit for naval warfare,—not one able to meet a foreign iron-clad in battle. Every requisite is wanting. The Navy has always former. Without a properly qualified Corps of Engineers, there can be no modern navy, for such is a purely steam navy, and the rôle of the Engineer cannot be filled by any substitute. If he be of inferior qualifications, or kept in an inferior position, the sure result will be an inferior navy. Were it not for the power and prejudices of the sailor officer portion of the Navy, naval steamers would have no more of masts and sails than the transatlantic merchant steamers, which traverse the ocean for years with only jury-masts. Seamanship with sails, as applied to the navigation of vessels, has as completely departed from sound naval practice as the old stage-coach and its driver from the road. Steam machinery has supplanted all; but if the stage-coach drivers had had sufficient influence they would doubtless have remained, and, perched on the cow-catcher of the locomotive, appear to guide it while the engineer performed the real service behind.

Every naval steamer requires, for the proper care and management of its machinery, a number of Engineer Officers, and a large iron-clad requires many. The engineer department of a naval steamer demands a large force of skilled machinists, firemen, and coal-heavers, proportional to the power of the machinery, and forming a considerable percentage of the crew even when the steamer is equipped with sails; but in the case of an iron-clad, which is the only real naval vessel, the Engineer Officers and their machinists, firemen, and coal-heavers compose the principal part of the personnel. The Engineer Officers have to command these men, to distribute them for their duty, and to instruct them in it. A military organization is just as indispensable to them as to the sailor officers for the proper performance of these functions on board ship, and the Engineer Officers must have both the prestige and the power of rank in order to do their duty with the utmost efficiency. They cannot be directed in that duty by sailor officers, who know nothing of machinery or engineering, and any interference must be disastrous.

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At the present time, the true naval fighting vessel may be said to be propelled by machinery alone; its hull is of iron and has a form and construction totally different from the old wooden sailing hull, besides being defended by an armor of massive iron; the guns are enormous in size, and they are loaded and trained by machinery, which is likewise employed for nearly all the other operations formerly performed by hand. There being little or no occasion for seamanship—the peculiar knowledge of the sailor officers—very little, or nothing, of that trade remains, and the part of the crew still called "sailor," are the mere simulacra of their vigorous predecessors.

Had it not been for the very natural prejudices of the sailor officers for the rigging, tar, and canvas of their own profession, sails would long since have been as obsolete in the steamers of the Navy as in those of the merchant marine. Their retention for so many years after their usefulness was past, has been a source of great loss to the country; it has, in fact, so much retarded progress that the Navy does not, at this moment, contain a single vessel fit for naval warfare,—not one able to meet a foreign iron-clad in battle. Every requisite is wanting. The Navy has always been controlled by the sailor officers, and wooden, unarmored hulls, full sail power, and small guns bear witness to the difficulty with which any class of men accept new ideas that threaten their supremacy, and the ease with which public interest can be sacrificed to private.

When sails were superseded by steam machinery, there necessarily arose a new class of officers, the Engineers, and a new kind of crew, namely, machinists, firemen, and coal-heavers. This new kind of crew were not sailors, and knew nothing of a sailor's trade; they were under the control of the Engineers, and employed solely for the service of the machinery. This kind of crew is very numerous, and has of necessity to be commanded by the Engineer Officers, several of whom are required for each vessel; and an organization of military rank, with corresponding position and power, so far as will enable the professional duties to be performed in a proper manner, are absolutely essential to the public interest and to the efficiency of the Navy. Against this obvious necessity are opposed the mere wishes of the Line or sailor officers, who naturally desire to be still considered the only naval officers, and are wholly unmindful of the enormous change in naval affairs which the introduction of steam machinery has effected. The palpable injustice of such a state of things, and the injurious consequences resulting therefrom to the public interest, should cause a reformation in the only thorough and practicable manner, namely, by giving the Engineer Officers proper military rank and title.

The force of the reasons hereinbefore stated caused, several years ago, a *quasi* or relative rank to be accorded by Congress to the Engineers, but against the violent opposition of the sailor officers, who had sufficient influence to prevent the giving of absolute rank and the appropriate naval titles. This *quasi*-rank has failed to remove the dissatisfaction of either party; it was in the right direction, but did not extend far enough. Congress, it is hoped, will

Officers might be regarded with a smile at its absurdity; but the Navy of the United States belongs to the people of the United States, and the proper position and recognition of a class of officers on whom its efficiency and glory must largely depend in the future is a matter of serious public concern.

RELATION OF THE DUTIES OF THE NAVAL ENGINEER OFFICERS TO THE PROBLEM

By Passed Assistant Engineer John R. Edwards, U. S. Navy.

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RELATION OF THE DUTIES OF THE NAVAL ENGINEER OFFICERS TO THE PROBLEM.

By Passed Assistant Engineer John R. Edwards, U. S. Navy.

[Continuation of lectures delivered at the Naval War College, Newport, R. I., August, 1895.]

Second Lecture.

The following problem was proposed to the class at the War College:

May 10th.—War is imminent. The enemy is assembling in Halifax. He is expected to descend upon the New England coast. His probable plan is to occupy the coast and chief cities from Portland to Boston, thereby seconding certain movements of his land forces. His success depends upon his completing this occupation before June 10th, and maintaining it until July 10th. The force destined for this purpose is one or more fleets, whose total strength is three times that of our fleet, and 20,000 men in 50 transports.

Our available force is ordered to assemble for the present in Nantucket Sound.

May 20th.—War is declared. A fleet leaves Halifax, occupies Provincetown and blockades Boston May 23d. Is composed of 6 battleships, 8 armored cruisers, 18 cruisers, 12 gun boats, 12 torpedo boats. Gains and keeps touch with our fleet, wherever it may be, by means of scouts.

Our force is 5 battleships, 5 armored cruisers, 15 cruisers, 10 gun boats, 10 torpedo boats, 1 ram. A heavy monitor at Boston, a light one at Portsmouth and another at Portland, are to be retained at those points. We learn that a much larger force of the enemy is about to leave Halifax. It sails thence May 25th, blockades Portland, occupies Casco Bay, and gains touch with its Provincetown fleet, May 27th. Is composed of 10 battleships, 15 armored cruisers, 20 cruisers, 20 gunboats, 20 torpedo boats and 50 transports carrying 20,000 troops of all arms.

Design plan for meeting this demonstration.

Show best disposition of our forces and describe in detail our preparations for the campaign.

THE WORK OF THE CORPS OF NAVAL ENGINEERS BEFORE GOING INTO ACTION.

Early in April, the Secretary of the Navy and the Admiral commanding the defence fleet had several protracted consultations with the Engineer-in-Chief in regard to the threatening aspect of affairs on the New England coast. Imperative orders were given the Bureau of Steam Engineering to put the machinery of every war vessel in the highest state of efficiency. Unlimited expenditures were authorized, and instructions given to effect such alterations as would make each vessel a most reliable fighting machine; but every improvement suggested in any vessel had first to receive the approval of the Admiral in command.

The Commander-in-Chief of the defence fleet, in urgent terms, requested the Engineer-in-Chief to nominate as Fleet Engineer an officer who possessed the following requirements: Ready in resource and of engineering constructive ability; not over 45 years of age, yet quick of judgment and with a broad knowledge of the plans of our various types of ships; capacity for work, and rare executive ability; with considerable sea service; great love and knowledge of his profession; of some personal magnetism, and of great will power and fixedness of purpose.

Nearly every Chief Engineer on the active list applied for this duty, but by reason of age their requests were denied.

It was urged by the Admiral, who was under 55 years, that no one of any staff corps who had served in the last war should, on account of the age of those officers, do active work at sea. Line officers might go as commanders of vessels, but then they should only be sent on battleships and armored cruisers, or as Flag Officers.

It was recalled to mind that Admiral Farragut's Fleet Engineer was only 33 years of age when the forts below New Orleans were passed. In looking across the sea it was observed that the English Admiralty appoint as Engineer-in-Chief of their great and powerful navy only a comparatively young man, who, of course, is continued in office if he shows matchless talents for the work. We have followed their example in this respect, and when able men have reached the position of Bureau Chief they are never disturbed. Even in time of profound peace and when such conservative action as the building of the *Charleston* with her compound engines had been authorized, our present great Engineer-in-Chief was appointed—a man who at that time was about 47 years old.

Some difficulty was found in securing an officer to fill the post of Fleet Engineer, which was regarded by the Secretary as next in importance to that of the Fleet Captain. An examination of the January Register showed that every officer on the list of Chief Engineers was beyond the age limit set by the Admiral.

With great earnestness the Engineer-in-Chief urged that the Admiral's wishes be respected in regard to the request for a Fleet Engineer. The old officers insisted on being sent. A very able Fleet Engineer was ordered who was over 50 years of age. Within two weeks he physically collapsed under the great strain of almost continuous day and night work. During that period he had rendered invaluable service to the fleet, and some of the changes, made under his supervision, had an important effect upon the result of the great naval battle fought off the Massachusetts coast.

His successor was one of the young officers who had been trained under the personal supervision of the Engineer-in-Chief. With such a preceptor, it was but natural that he had acquired decision and quickness of judgment and a confidence which was ready to assume great responsibilities. Thoroughly conversant with the definite policy which had actuated the work of the Bureau of Steam Engineering, he knew the strength and weakness of our ships, so far as their structural arrangements and motive power were concerned. Incessant work for a dozen of years in studying marine engineering questions, both at the Bureau and at sea, made him no stranger to the duties before him. He had made one cruise at least, as a virtual Chief Engineer, although the official records showed that he served as assistant.

The Secretary of the Navy considered his duties of such importance that, in a personal interview, he impressed the fact upon this officer that the preliminary work of the Corps of Naval Engineers might avert the calamity, which a sorrowful nation was hoping and praying would not prove a verity.

The Secretary then commended him to the favor of the Admiral of the Fleet; and with the knowlege that, no matter how great the service he might render, there would be no grateful nation to hold him in remembrance, he entered upon his duties. He only knew that the Recording Angel wrote in letters of gems those deeds of valor and worth which have passed unnoticed and unrecorded on earth.

Within a few days the Commander-in-Chief was impressed with the fact that in his Fleet Engineer he had a most valuable assistant. Casting aside the traditions of the past, he showed himself a great man by overcoming the prejudices of his four decades of naval life. Into his full confidence this fleet officer was taken, and then he was given carte blanche to prepare for the inevitable battle.

Here are some of the changes that were wrought:

One of the scouts was sent for several hundred bunker plates and frames of standard size, so that the upper bunkers of the several ships could not only be coaled more rapidly, but be made more habitable in action. Under the direction of the carpenter, the holes in the deck planking were cut to a size scant of that required.

Another scout was sent to the nearest seaport to Lynn, to bring men and electric drill outfits for cutting additional holes in the protective deck. Doors for closing the openings thus made were ordered from Bethlehem and Pittsburg, the detail drawings having been made by one of the assistant engineers.

Emergency chutes which opened directly into the several fire rooms were built within the bunkers. These extended from above the upper bunkers, through the protective deck, and had suitable doors for preserving the water tight features of the vessel. The extra coal carried on deck could be delivered into the fire room without opening a bunker door; and with the increased number of deck scuttles fitted into the upper bunkers, all the deck force not otherwise engaged could, in a chase or when escaping from an enemy, carry coal from this bunker and empty it into the emergency chutes. This would not interfere in any way with the coal passers working below.

And, if one of the longitudinal bunkers should become filled with water, coal could be brought to the fire room through these chutes and supplied to the furnaces. As formerly arranged, it was absolutely necessary to open a bunker door to procure coal, and in the event of a hole being made in the hull, either by a torpedo or the vessel striking some object, the doors leading to the impaired bunkers had to be closed. The Fleet Engineer regarded these emergency chutes as of vital importance.

He called the attention of the Admiral to the ill-contrived arrangement of deck pumps as fitted on nearly all the ships.

On the deck of a certain vessel in the fleet, the three athwartship passages were blocked by six Downton or Stone Pumps. The brakes, when manned, required more deck room than an eight-inch modern rifle. When called to fire quarters, and with 96 men on the cranks of the six hand pumps, working against a 25-horse-power steam pump, a complete stoppage of the deck outfit occurred.

The Admiral, alarmed at this state of affairs, called a survey upon the fire main and deck pumping arrangement. As bilge pumps, they were found to work so slowly that they were practically useless. No one could give any satisfactory reasons for their being placed in a modern vessel. At sea, where steam was always maintained, they were never used. At a navy yard, the ships would be laid up within a short distance of a fire plug, and for the lone watchman in charge of the ship, the use of a water bucket would be the best method of fighting a fire single-handed.

To the great joy of all the gun crews, the deck pumps were disconnected and all sent to a navy yard, where they took up valuable room in one of the buildings, thus robbing the scrap pile of its legitimate prey.

The valuable space secured on board by the removal of these pumps was utilized in many ways. Later, the capture of one of the enemy's cruisers was due to the fact that one of our vessels was able to prolong the chase for several hours, by reason of carrying 30 additional tons of coal in jute bags in the space previously occupied by the deck pumps.

Formerly, when all the boilers were in one compartment, and this became flooded, the deck pumps might have been of service. But in a modern ship, where the boilers are in several compartments, it is not likely that all the fires will be put out at once. If such a calamity should occur, the quicker the crew took to the boats the better. Those who remained with the pumps would probably find a watery grave.

As an alternative, in case the space gained by sending ashore the numerous deck pumps was not wanted for coal, it was suggested that a coil boiler plant and steam wrecking pump, which would be of some practical service, be installed. Steam would always be kept low on this boiler when the ship was under way.

INCREASED HEIGHT OF SMOKE PIPES.

Additions were made to the height of all the smoke pipes. This excited some comment, as it was supposed that we already had tall funnels on our vessels. An examination of the *Marblehead*, a vessel which was said to have been ruined in appearance by her tall pipes, showed that their tops were only fifty-seven and one-half (57½) feet above the grates. Those who had made a cruise in the *Chicago*, previous to 1895, hardly recognized the ship with her new and tall pipes. In the eyes of the Admiral she was beautiful, for he knew that these high shafts were marks of efficiency, and that they increased her sea speed. The cruising speed of the fleet was materially assisted by this action and the efficiency improved.

A RADICAL CHANGE WAS MADE IN THE FIRE MAIN SYSTEM.

Instead of a line of piping, which contained so many angles and sharp bends that there was practically a stop to some of the plugs, a carefully devised arrangement was secured. Fire plugs were placed everywhere, and only full opening valves fitted. The lengths of rubber hose were such that one man, or two at the most, could run out a section. At least two steam pumps, one forward and the other aft, were installed outside of the engine and boiler compartments. These pumps had coal and side armor protection, and, being fitted with relief overflow valves in the pipes, were meant to be run continuously during action.

As an example of a poorly designed lead of piping, one of the vessels may be cited, where the fire bell was rung during the Admiral's inspection. The engineer's force led out their two sections of hose; two powerful steam pumps, in perfect order were at work on the fire main; two gun's crews helped to hold the hose to prevent kinks, and yet only a small stream issued from the nozzle.

The complaint has come from almost every one of our men-of-war that the Officer of the Deck, while constantly asking for more water on the morning watch to wash down decks, could not secure it, although powerful steam pumps below were working at their utmost power. If sufficient water can not be secured to wash the deck, what are we to do in case of fire?

INSTALLATION OF ADDITIONAL FANS AND BLOWERS.

The Fleet Engineer gave warning in regard to the enormous quantity of top hamper with which only too many of our battleships are oppressed. An "Engineer" editorial of June 5th says: "We have deck houses and bridges and boats and cowls. These would be converted in five minutes by machine and quick firing guns into matchwood. Probably this matchwood would be set on fire. No wooden structure of any kind should be permitted on the upper deck. This was the lesson of the *Yalu*. As to the funnel, it is clear that with anything like a smooth sea and a moderate range, machine guns could cut these off pretty short. The cowls and ventilators would be reduced to small scrap.

"The existence of a war ship as an antagonist must depend in action on her fans, and we have never yet been on board a man-of-war, in which the fan arrangements appeared to be the best possible."

The blower arrangements were improved, but not to the extent that could have been done if more time had been given. Temporary provision was therfore made for the ventilation of the vessels, in case the ventilators were cut away by small shell. The vital air shafts were so arranged that nothing the enemy could do would affect them. It was strange that the ventilating question had to be settled on the eve of battle.

QUALITY OF THE FUEL.

An inspection by the Fleet Engineer of the bunkers of the several ships showed that they contained various kinds and qualities of coal. There were anthracites containing from 2 to 14 per cent. of ash and there were even mixtures of the red and white ash varieties. There were bituminous invoices which had been exposed to the weather and whose hydro-carbons had, in great part, volatilized and passed off. There was even a quantity of fuel which resembled peat more than it did coal. The sizes varied from steamboat to barley buckwheat. He knew that the efficiency of the vessels would be impaired by the possession of such fuel, for in action, when it would be necessary to force the fires to their utmost, there would be no time to select coal. That within reach would be taken, and such a mixture of various inferior kinds, as was found by the Fleet Engineer in the ships, would result in the rapid formation of clinker, which, containing a large percentage of unconsumed carbon, would not only entail a great waste of coal, but decrease the efficiency of the boilers. This investigation resulted in the appointment of a Board of Naval Engineers, to determine the quality and character of the coal supplied to our war vessels on the Atlantic coast.

VIEWS IN REGARD TO SUPERIOR BOILER POWER.

Repeatedly during their many consultations, the Engineer-in-Chief had impressed the Admiral with the superiority of our vessels in "boiler power" over that of the enemy.

It was shown that in battle our vessels would be kept moving, and that the enemy would be given no chance of preparing for a rush at full speed under forced draft; that our ships, with larger boiler power and their increased ratio of grate surface, would be in an efficient state when those of the enemy would have their fires full of clinker, tubes choked and firemen exhausted.

In a series of letters to "Engineering," a correspondent, "Argus," calls the attention of the Admiralty to the superiority of the United States in this respect. He says: "The question is, *Are British ships supplied with such boiler installation* as compared with those in ships of the same class belonging to possible enemies, as to secure us the advantage, both in tactics and strategy in the event of war? And the answer is: *They are not, most emphatically not, neither existing ships, nor ships building.*"

The Admiral informed himself of the *sustained speed* and boiler power of the vessels, class for class, so that he might know just what tactics to pursue. And in doing this, he was not led astray by the delusive figures given in the reports of trial trips made on " normal " displacement, when perhaps there was not as much as one-half the coal and stores on board that the ship would carry when ready for an engagement; but he compared them on the basis of their load displacements and their boiler powers. For, given equally good men in each ship, and an equally good quality of coal, of two ships having the same displacement, that one will be the faster which has the greater boiler power.

Taking them class for class, our ships are more powerful in their machinery than those that will operate from Halifax. The accompanying table shows that the *Indiana* and *Massachusetts* are but slightly inferior, actually, to the battleships of the British *Royal Sovereign* class; but as our vessels are of considerable less displacement, it will take about 20 per cent. more power to give the first class battleships of the enemy the same speed as the *Indiana* class. This they have not; and so it may be confidently accepted that, so far as sustained speed is concerned, our ships are at least equal to the best that the enemy can concentrate. When it comes to the *Iowa*, we have a ship that in boiler power is far superior to anything that can be brought against her in the battleship line, and is only inferior in boiler power to armored cruisers of the enemy.

Coming to the armored cruisers, the *Maine*, though larger than the vessels of the *Australia* class, is shorter and has not such good lines for speed; but she has greater boiler power, and may be expected to maintain nearly, if not quite as good speed as the *Australia* class. The *New York* is fully 15 per cent. more powerful than the *Blake*, and the *Brooklyn* has practically the same power as the *Blenheim*, so that the ships we have of this class are not at all inferior.

Coming down to the protected cruisers, it will be seen that the *Columbia* and *Minneapolis* have fully 75 per cent. more boiler power than the first class cruisers of the *Edgar* class; and while they will be of greater displacement when fully loaded, they are, in point of speed and endurance, unapproachable by any vessels of the enemy's fleet. The *Olympia*, though much smaller than any of the hostile first class cruisers, has greater boiler power than any of them, and is, therefore, capable of doing any duty in scouting or raiding that could be expected of a ship in possession of the enemy; and, owing to the superior design of her boilers, she could do this duty much more economically.

COMPARISON OF THE BOILER POWER OF VESSELS OF THE U. S. AND BRITISH NAVIES.

Ship.	Displacement.	I.H.P.	Grate Surface.	Heating Surface.	Ratio of Heating to Grate Surface.
Royal Sovereign Class	14.900	11,500	731	20,348	27.8
Indiana	11,600	9,000	616	19,195	31.1
Iowa	12,000	11,000	756	24,038	31.8
Australia Class	5,600	8,835	514	15,502	30.1
Maine	6,800	9,292	574	19,015	33.1
Blake	9,000	14 525	871	27,192	31.2
New York	9,000	17.400	1,052	32,958	31.3
Blenheim	9,000	21.411	1,135	31.073	27.4
Brooklyn	9,000	17,000	1.016	33,429	32.9
Edgar Class	7.700	10.517 12,851	812	24,908	30.7
Columbia	8.100	18.500	1,408	45,221	32.1
Minneapolis	8,100	20.860	1,520	50,147	33.0
Vulcan	7,000	12.062	564	15,861	28.1
Texas	6,800	8,600	532	19,912	31.8
Mersey Class	4.050	6,151	388	11,565	29 8
Charleston	4,050	6,666	436	15 577	35.7
Forte Class	4,360	9,274	575	15.641	27.2
San Francisco	4.300	9,913	577	20,135	34.9
Archer Class	1,770	3.754	222	6 836	30.8
Yorktown Class	1 800	3.400	220	8,092	36.8
Medea Class	2,900	9,268	526	13,264	25.2
Cincinnati Class	3,213	10,000	617	20,179	32.7
Apollo Class	3 550	9.274	575	15,641	27.2
Pallas Class	2,600	7,469	410	11.025	26.9
Detroit Class	2,100	5,400	394	11,004	27.9
Buzzard Class	1,140	2,000	...	...	...
Machias	1,200	1.800	120	4.590	38.2
Royal Arthur	7,700	10,086	731	24,828	33.9
Olympia	5,800	17,000	828	28,300	34.3

When we examine the boiler power of the smaller cruisers, we find that we are quite as well off as we are in the larger ones. The *San Francisco* and *Baltimore* class of cruisers are superior to those of the *Forte* class, while the *Cincinnati* and *Raleigh* are ahead of the *Apollo* and *Medea* classes. The opposing fleet also has smaller cruisers somewhat like the *Detroit* class, the *Pallas*, *Pearl*, etc. Although they are rated at 7,500 I.H.P. against 5,400 for the *Detroit* class, an examination of the table will show that there is practically no difference in the boiler power, and that, therefore, we should expect almost as much power from the *Detroit* as from the *Pallas;* but the latter vessel is some 500 tons larger than the *Detroit*, and, therefore, the *Detroit* ought to be the faster.

The vessels of the *Mersey* class, of which there are only four in the British Navy, are comparable with the *Charleston*, which has a good margin of power in excess of the *Mersey*, and, although slightly larger, is unquestionably faster.

Another point that must not be overlooked, in connection with the boiler power of the ships of our fleet, is that there is a larger ratio of grate to heating surface in all of them, and that they will consequently be able to do their special duty with a less expenditure of fuel.

It will be particularly noticed that, in the three types of vessels in which the plans were purchased abroad, we have not that marked superiority over our trans-Atlantic cousins in horse-power.

FLOODING COMPARTMENTS.

An inspection of the fleet showed that in some of the vessels no provision had been made for flooding every compartment. Fire is an element which will have to be fought by the crews of a war vessel, and the occasion may arise when a compartment will have to be flooded to save a ship. This was one of the lessons taught at the Yalu.

An exceedingly able writer in one of the June numbers of "Harper's Weekly" speaks as follows upon this subject:

"When the fires began to burn fiercely on some of the Chinese vessels, it was found that there was no means of flooding the compartment where the torpedo heads were stowed, preliminary to being brought into action. This was an added source of danger, and it became necessary to throw the torpedoes over-board at once. It is probable, as a result of this, that further improvements will be necessary in the construction of war ships to avoid such danger in action."

Without going into dock, flood cocks were attached to the hull, and pipes fitted, and the defect of not being able to fill the compartments with water was overcome.

Everything was subordinated to placing the boilers and engines in a state of maximum efficiency, for the Engineer-in-Chief had convinced the Secretary of the Navy that in a modern war vessel the motive power had become a weapon, and that for special purposes it was superior to the gun.

Speed, and particularly its control, is the cardinal element of tactics. Ability to manœuver is now more dependent upon the number, form and position of the propellers, and the shape of the hull, than it is upon the skill of the commander. They are, therefore, the qualities and attributes of a weapon.

But the motive power is more. It is a defense, and in many respects of more importance than the armor. It gives the commander the option of avoiding or forcing a contest and, with marked superiority in speed, he may determine the strategy of the battle.

There are other ways of rendering a ship useless than by killing the men at the guns. Continuous work in an ill-ventilated and contracted fire-room will cripple the efficiency of the steam weapon below the protective deck.

That voyage of the *Columbia* across the Western Ocean is going to be fraught with great results. What mysterious power suddenly gave our people confidence when they read of the splendid run of the matchless *Pirate?* It was because the Nation had a glimpse of the future, and was told that speed was *par excellence* the weapon of the ship of war.

The run of the *Columbia* between the Needles and Sandy Hook settled the speed question of our war ships for the remainder of this century. Those who think our ships go too fast are likely to find out that our people believe such critics move too slowly. And those who complain of the excessive horsepower of our vessels will find few people to argue with them.

FLOATING WORKSHOPS AND REPAIR SHIPS.

There had been fitted out for the use of the defense fleet two floating workshops or repair ships. They were called the *Corliss* and *Fulton.*

The men in charge of the several tools had been so instructed and drilled that, in case of the capture of the repair ship, some vital part of each machine could be disconnected very readily. The ships were in great part fitted with duplicate machine tools in order that the continuance of any special work could not be interfered with. And, in case it was found necessary to sink one of the vessels to prevent her from falling into the possession of the enemy, the other would still be available to carry on the special work.

It is unnecessary to give a list of the machine tools and outfit, but in general it can be said that they were the equal of anything of that description afloat.

The workmen were nearly all members of the New England Naval Reserve, and probably had no superiors in the world as rapid and skilful artisans. Trained in the use of small arms and rapid fire guns, and subservient to discipline, their work and conduct received the special commendation of the Commander-in-Chief.

All repairs were made under the direction of an Engineer Officer, who had as his assistants some of the ablest mechanical engineers in New England. These men had voluntarily offered their services until the close of the war, and their patriotic employers had sent to the repair ships the pride and pick of their several establishmments.

The equipment of the repair ships was placed absolutely in the hands of the Engineer-in-Chief. In general it may be said that the outfit was of such a character that it was capable of fitting up any casting from a two-ton cupola. Any plate whose width was less than 48 inches could be handled successfully, irrespective of length. Particular care was taken that the repair ships were not loaded down with too many tools. They were not intended, nor was it possible, to make them floating dock yards. The impracticable suggestion, to equip them in a manner resembling a ship construction plant, was not seriously considered. Plates, which could not be conveniently handled aboard such a ship, were too large to be manipulated anywhere except at a great ship building plant.

It would take many lectures to tell of the work accomplished on these vessels, but the Proceedings of the American Society of Mechanical Engineers for 189–, tell in detail of the work accomplished and the scope of their usefulness.

AUXILIARY NAVAL REPAIR STATIONS.

As the usefulness of a repair ship is greatest for service abroad, or when the fleet is operating at some distance from its base, the Navy Department, after mature deliberation, decided upon another method of making the ships efficient.

The Secretary, therefore, ordered the Engineer-in-Chief to co-operate with the Admiral in command and to make the necessary arrangements to establish repair stations.

The American Society of Mechanical Engineers and the Marine Engineers' Beneficial Association of the United States, through their executive officers, called upon the President and tendered their services, requesting particularly to work under the special direction of the Engineer-in-Chief.

It was realized by the President that our only hope of success, (with our naval force one-third as powerful as that of the enemy,) was in having our fleet maintained in the highest state of efficiency, so that our maximum force could be utilized for a decisive blow at almost any hour.

The president of the Marine Engineers' Association had special interviews with the Secretary in regard to the status of their members upon entering the naval service, but more will be said on this subject in another lecture.

Six of the best appointed engine plants in Rhode Island, Connecticut and Massachusetts, which are accessible to the sea, were turned into Auxiliary Naval Repair Stations. There the great bulk of the repairs of the fleets was made.

Blue prints of the machinery drawings of all the vessels of our fleet were sent to each of these establishments. Many of the most skilled mechanics of the various shops were taken aboard the ships and given instruction in regard to the absolute necessity of implicitly following orders, both in regard to the character of the material and the details of the various parts.

Under the direction of Naval Chief Engineers were eminent Mechanical Engineers, who were placed in immediate charge of these repairs. Thoroughly posted in regard to the resources of the plants, and with an intimate knowledge of the personnel of the various establishments, repairs were made with surprising rapidity. The fast steam yachts *Vamoose* and *Feiseen*, and other boats of their speed, were detailed as despatch boats between the fleet and the harbors nearest to the repair plants.

Whenever the repair was of a small but important nature, but beyond the resources of the fighting ships, orders were given in the different shops to make several of the parts required. The new pieces were sent aboard by different despatch boats, and it was quite certain that at least one part would reach the vessel it was intended for.

COMMUNICATION BETWEEN CONNING TOWER AND ENGINE ROOM.

A very decided improvement was made in the method of communicating between the conning tower and the engine room. Changes were made in the size, shape and location of the mouth pieces of the speaking tubes. Additional mechanical telegraphs were installed, likewise a simple, reliable bell pull. Those contrivances of the dreamer, which may be a success of the morrow, but which are unreliable toys of today, were discarded. Suitable key words for certain work were agreed upon. When it was found necessary to pass orders by word of mouth, single expressive terms which could not be misunderstood were employed.

Our enemy had also swept from their decks the worthless contrivances for communicating with the engine room, for a London "Engineering" leader had warned them as follows :

" For example, what is the use of an elaborate series of speaking tubes from the forward conning tower to the engine room, down which no intelligible message can be transmitted, even under ordinary conditions when the engines are running, and which would be utterly useless in the noise of an action. What can be said in favor of electrical signalling arrangements which cannot be trusted even on a peaceful cruise. The engineer would take very good care to provide signalling arrangements which, if they did not permit the captain and the chief engineer to consult with each other, would not fail to tell the latter what the former wanted the engines to do."

ENGINE AND FIRE ROOM WATCHES.

The fire and engine room watches of all the vessels were drilled and trained, so that each one of the enlisted men could do the duties of the next higher rating. As a victory was looked for, the Fleet Engineer thus provided in part for future contingencies. He thoroughly realized the fact that the engineer's force would be well employed and under great pressure before, during and after the battle. The collapse of many good men could therefore be expected, and provision had to be made for such casualties.

He knew also that, in the case of victory, it would be reasonable to anticipate that some of the enemy's ships would be captured. Such ships would either have to be destroyed, or prize crews placed on board to take them to an American port. Such crews must necessarily contain a large proportion of officers and men of the steam department, which could not be arranged, under existing circumstances, without crippling the fighting power of our own vessels.

The Fleet and the several Chief Engineers had given serious consideration to the best method of arranging the fire and engine room watches. The Admiral and his council of commanders, after mature deliberation, had decided that the organization of the engine force could best be done by the chiefs of the respective ships.

In general it was determined to arrange the watches as follows:

1st. When chasing, or escaping from an enemy, or when making maximum speed for a protracted period. The men should be placed in two watches so long as this did not continue beyond thirty-six hours. This was terrible work when taking into consideration the circumstances under which the men lived. After battling with fires forced to their utmost, it was impossible for men to sleep and rest until they were freed of the strain and excitement. In order to have the men secure some rest between the watches, it would be necessary to work them six hours at a time.

For a long voyage, the men should be placed in three watches, and then relieved of all drill and routine duties. And in addition, there would be a detail of men from deck helping to get out coal. It must be realized that no one can take the place of the fireman, no matter how cheerfully he may volunteer for the duty. It is a mistake to suppose that the duty of a fireman is similar to that of a navvy ; the navvy simply requires strength, the fireman requires also skill, brains and courage. All that the deck force can do to assist those below will be to help bring the coal to the fire rooms.

The Chief Engineers of all our vessels have been urging that the coal passers be taken out of the Powder Division.

In an official report, the Chief Engineer of the *Columbia* wrote: "The force of firemen and coal passers is not sufficient for natural draft, steaming with all boilers, except when coal is very convenient to the fire room."

This is what the Chief Engineer of the *Chicago* wrote upon the same subject: "I deem it my duty to state that the personnel is entirely too small to admit of the proper care of the machinery, and utterly inadequate to sustain the proper efficiency of the Engineer Department during an engagement. One-third of the Department being transferred to the Powder Division, leaves many important stations, such as stop valves, bearings, &c., without special attendance, which will lead to serious disaster during battle." Captain Mahan comments thus on this report: "The above representation of the Chief Engineer shows, in my opinion, the necessity of a general consideration of the question of actual necessities of an engine room in action. The efficient working of the Powder Division of the *Chicago* required that deduction from the Engineer Force."

Is it not possible to help matters, both in the engine room and on deck, by improving the arrangement of magazines, and the manner of supplying and hoisting the ammunition? Surely some better way can be found than the present methods.

The great weakness of the *Columbia* and *Minneapolis*, besides the arrangement of their coal bunkers, lies in the method of supplying ammunition, and if this defect were overcome, the Powder Division could do more efficient work with fewer coal passers. More men could then be secured for the fire room, where there would be urgent duties for them to perform.

Another engineer officer writes: "It takes one-third of our force to run launches, keep steam on the ship, evaporate and distil water, run pumps and attend to the numerous auxiliaries. When a third is taken away every day to assist the Powder Division, it leaves us the remaining third, an insufficient number, to do the work of the Department."

Our highest officers pay tribute to the efficiency of the drill of the Naval Reserves; and if this skill can be acquired by working one hour a week for ten months of the year, why can't our engineer's force secure all the experience they require in this direction by drills, two days of the week the entire year?

The entire engineer's force should be instructed in everything relating to a gun, but they would take much more interest in these drills if one of the junior engineer officers could have charge of them. With their Annapolis training, surely these officers are competent to do this work. And it is not at all improbable that, if a shower of bullets should clear the decks of our gun division officers, an occasion might arise where the services of the junior engineers would be required to take charge of the batteries.

STATION BILL WHEN IN ACTION.

It is not probable that a naval conflict in the future will be prolonged beyond six hours. For that period, and for an hour or two before and after the battle, the entire engineer's force will have to work continuously. Improvements can and should be made in the manner of supplying ammunition. If this were done, the Powder Division, with one-sixth of the engineer's force, could do better work than they now accomplish. Two-thirds of the force should be stationed in the engine and boiler compartments. With one-sixth on deck helping to supply shell to the guns, there would then be a remaining sixth to form an "Emergency Watch," which would be under the charge of an assistant engineer. This squad would look out for the fire hose; stop valve gear on deck; make repeated examinations of the bunker water tight doors; observe the operation of every steam and hydraulic machine outside the engine and boiler rooms; inspect at intervals the leads of the steering gear; stand by to work the steering appliance from below if the deck gear should be carried away; and be in readiness to effect temporary repairs or overhaulings to any inefficient or disabled auxiliary. As they would be picked men, they might be able to render effective aid should any of the gun mechanism jam. It is almost impossible to tell of the many possible ways in which their services could be utilized.

Mechanics are not to be found aboard ship in the deck force. I have never seen a good vise hand outside of the engineer department aboard any of the fifteen ships that I have been attached to. There have been excellent blacksmiths, but they were neither capable nor anxious to do the work of either boiler maker or machinist. I am quite positive that during the three years I was aboard the *Petrel*, we never had target practice without having some slight hitch in the breech mechanism of one of the six-inch rifles. This was not the fault of the guns, but it was due to stupid work on the part of some Wallabout recruit or Asiatic "beach comber." Therefore the usefulness of the "Emergency Watch" is vast in its possibilities, and if these men could have special drills in dismounting guns, &c., they might become an important factor in helping to determine the result of a battle.

Wherever it was possible to do so, improved methods of heating the feed water were substituted for those now in use. In several of the ships part of the bunkers were torn out to find room for these appliances. The Superintending Marine Engineers of several great English steamship companies have told me that, in their opinion, the one great cause of the breakdown of the Scotch boiler in the British Navy has been due to the fact, that the engineers were not given sufficient space to install a suitable heating plant for the feed water. On some of their ships, the boiler power has been imperrilled by fitting some worthless heating tank, instead of a properly designed feed water heater. Their engineers know very well that the water has not been going into the tanks hot enough, but they are powerless to remedy the evil, as a request for room for this purpose is denied, with the answer that the engineer has too much room already.

In the short space of time that was permitted to prepare for battle, the development of electric power for many purposes suggested in the engineer's department could only in part be carried out. No better authorities on the question can be found than S. Dana Greene and W. S. Shallenberger, both formerly of the Naval Service, and the absence of some of the motors recommended by them was greatly regretted on all the ships, on the day when they went into action and met the enemy.

THIRD LECTURE.

THE WORK OF THE CORPS OF NAVAL ENGINEERS IN BATTLE.

On the night of May 29th, the steam yacht *Now Then*, one of the Mosquito fleet, steamed into the harbor of Vineyard Sound. She reported that one of the enemy's battle ships and one of the heavy cruisers had been seen moving slowly to the eastward, accompanied by a torpedo boat, a steam collier, and one of the floating workshops. The two large vessels appeared to be in distress, for the torpedo boat moved constantly from the workshop to the war vessels. The *Now Then* had watched these vessels until dusk. She had to keep too far away from them to gather any definite information, but the Ensign in command felt convinced that the enemy's vessels were bound either for Halifax, or some point to the eastward, where important repairs were contemplated.

This news was communicated to the Commander-in-Chief, who immediately congratulated the little scout on her pluck and good luck. The Chief-of-Staff was ordered to have the fleet leave harbor before midnight. The Admiral's face brightened as the Captain of the Flag Ship pleasantly remarked, that the little scout had a very suggestive name for a time of battle.

CONDITION OF OUR FLEET.

Our ships were in a high state of efficiency. They not only had clean hulls, but full crews. The bunkers nearest the fire rooms were filled with selected coal, and to save the men from overwork, this coal had been placed aboard and stowed by shore people.

The several departments of every ship had a full supply of stores, sufficient not only for ordinary cruising, but for unusual emergencies. The crews were in excellent health, having had considerable rest, although standing watch and watch everywhere, except in the engine and fire rooms. Under the peaceful shelter of the harbor highlands there had been no fear at night of torpedo attack. The men were therefore free of that intense strain under which the sailors of the blockading fleet were supposed to labor.

There were no sick aboard, and as an almost perfect commissary system had been established, the crews were prepared for protracted and severe work.

Dark clouds gathered on the horizon on the early morning of Decoration Day. While our sorrowful people were preparing garlands and tokens, to honor the heroic dead who had fallen in battle in the Wilderness, or on some such field as the Bloody Angle at Spottsylvania, the crews of the defense fleet were called to quarters and told to prepare for action.

CONDITION OF THE SEA.

With the early dawn the wind and sea increased. It was particularly noticeable to the commanding officers, that our men were somewhat superstitious concerning the result of a conflict on Memorial Day.

The Admiral had anticipated this action, and in a general order had reminded our crews that grief was the forerunner of glory, and that if all did their duty, Memorial Day would hereafter be associated in America with the greatest naval victory of the century.

Early in the forenoon watch, the enemy's fleet was sighted to the northward and appeared to be in readiness for action. Their numerous scouts and torpedo boats instantly steamed towards the shelter of the heavy battle ships. The fleet of the enemy steamed to the southeast, and it was evident that, if they accepted battle, it would take place some distance from shore. At this time there was quite a rough sea and considerable wind, which materially checked the speed of the smaller boats.

COMPARISON OF OLD TIME FRIGATES AND MODERN BATTLE SHIPS.

As our vessels approached the enemy, and saw their powerful battleships, the old sailors were impressed with the fact, as expressed by a correspondent from Kiel, "That modern navies can not reproduce the glories of the ships of the line and old fashioned frigates of Nelson's time. An old time man-of-war with her seas of snowy canvas was a thrilling sight. A fleet of such vessels, with sailors swarming in the rigging, was a spectacle for gods and men. The modern battleship, with all its defensive armor and tremendous batteries, can not be dressed for a holiday like one of the heavily rigged frigates of former days. It is a clumsy fortress in the water, without adequate facilities for decorative effect. It is an engine of war, a fighting machine, a marvel of engineering science, but with all the potency of its armaments, it has not the same power of arousing enthusiasm which the old line ships have exercised in the past. And a modern fleet, with its destructive engines and defensive resources, lacks capacity for lighting up imagination. It is an immense combination of smoke stacks, machine shops, engine houses and ordnance factories, tricked out with occasional bunting, but deficient in spectacular charm and fascination."

PREPARATIONS FOR ACTION.

The crews had no need to be told that, for the first time in the world's history, there was now about to be waged a battle of machines; and that victory would come to that nation, whose crews could handle and control the various engines of war with the greatest skill and for the longest period.

A few weeks previous to the battle, the engineers had been given absolute charge of the men in their department, but the demoralizing work and influence of a decade of faulty organization could not be wiped out in a day.

The fire room watch repaired to their stations below, and soon the clicking of metal warned them that some of the hatches were being battened down by the carpenter and his mates. The Admiral in command realized that his success that day depended upon the efficiency of the machinery, and to prevent anything from falling amongst the moving parts of the engines, the hatches were closed. Perchance many of the firemen, who went down that day in their ships of war, had some presentiment that their coffins were being sealed, when they saw the closing of the deck openings. The ring of many a hammer was the death knell of some brave fireman and coal passer.

APPEARANCE AND CONDITION OF THE ENGINEER'S FORCE.

The engineer's force presented a particularly fine appearance. Strong men, with intelligent faces indicative of character and loyalty, comprised this assemblage of mechanics and firemen. Always the neatest and best dressed division of a war vessel, they realized the worth and importance of their own services in the impending battle. Many were continuous service men, and although they had the unqualified respect of their engineer officers, but few good conduct badges adorned their breasts. An inexcusable system, whereby it was not the province of the Chief Engineer to recommend worthy men to his Commanding Officer for this honor, had deprived these firemen of these desirable badges. Their commanders had respected them too, but, in the midst of the multiplicity of papers, they had forgotten to reward the men working below. Coxswains-of-boats and captains-of-tops, who were under the immediate observation of the executive officer, never failed to receive such recognition when deserved.

With his quick eye and wonderful judgment, the Admiral realized the condition of affairs, and then he spoke words of encouragement to these men. Machinists, firemen, and coal passers knew that this brave man regretted the neglect of previous years, and that at last the time had come when their work was appreciated. A cheer of joy and gratitude went out from the hearts of these firemen, and when it was taken up by the crew, the Admiral was visibly affected.

COUNCIL OF WAR ASSEMBLED ON ALL THE SHIPS.

The Admiral of the defence fleet had given special orders that the Executive Officer, the Chief Engineer, the Navigator and the officers of the gun divisions should, in council of war, be notified, by the Commanding Officer of each ship, of the plan and details of the proposed fight, as far as the movements and actions of each ship were concerned, so that, in the very likely case of the destruction of the interior communications, each of these officers could still act intelligently and in accordance with the prearranged plan. On this subject, it may be interesting to note the following observations of the Commission of Inquiry on the French battle ship *Magenta*, taken from "La Marine Francaise":

"Inclosed in the conning tower, assisted by a few picked men, the Captain's whole care will be the manœuvering of the vessel; he cannot see his crew, nor cheer them by his presence and example, and can communicate his orders to them only by means of wires and pipes, the destruction of which, on their long circuit around the vessel, is open to many chances. If he has not, long before, given precise instructions to his officers; if these officers are not fully conversant with his ideas; if they have not, in their turn, instructed the crew in this respect; and if, finally, each man does not understand the details and importance of the part he is to fill, there will be, at the moment of combat, no assured communication with the Captain, and each party, shut up in a compartment of the vessel, will anxiously inquire what is taking place in the adjoining ones."

FINAL INSPECTION OF THE ENGINEER'S DEPARTMENT.

The Chief Engineer and his assistants made a final inspection of the fire and engine rooms. Provision had been made for getting the best work out of every machine, and they were in a most excellent state of efficiency. The men were kindly greeted and encouraged, and the example of their officers, in going about their duties so quietly and unconcernedly, inspired great confidence in the engineer's force. There was no piping of whistles and shouting of orders to men within speaking distance. The men were thoroughly posted in regard to their duties, and the watch bill had been so laid out, that each man knew the extra duties he was expected to perform, in case any should fall or become prostrated from the heat or overwork. Some spare tools had been placed within reach of the machinists, and all necessary stores were in accessible positions. The Emergency Watch made the rounds of the vessel and adjusted things where necessary.

A final consultation was held with the commander of each vessel. It was recognized by the several Captains that the man aboard ship, who had to be resourceful, ready to assume responsibility, and peculiarly fitted for his task, should be the Chief Engineer. In this hour of danger he was not told that he was an idler, and that "aboard ship he was a non-combatant." But he was reminded of the fact that his post was one of danger, and that upon the efficiency of his department would depend the result of the conflict. For speed is now a weapon in naval warfare, and he who controls it can look for victory. The Chief Engineer had no need to be told that, when the fight was over and the crews mustered, it would be found that a greater percentage of the firemen than of the seamen would rest that night under the surging waves of the Atlantic.

OPENING OF THE BATTLE.

Gradually our fleet overt ok that of the enemy. A flash of fire, a puff of smoke, the wh ng in the rigging of a projectile, and then commenced the h ttle of Chatham.

From the time the first s ed, the enemy made every effort to render the vessels of our squadron unmanageable. Shell were fired at the water line aft, with the hope that some fragment would strike a vital part of the rudder and screws, or some one of their attachments. To the great dismay of our Admiral, the *Brooklyn* was partially disabled in this way. It was found necessary to steer the vessel by means of her screws.

Some of the hatches had been battened down, and the temperature of the engine room had risen to over one hundred and fifty degrees, within a half hour from the time daylight was shut out. The annunciator signals worked rapidly. Midway between the high pressure cylinder and some auxiliary machines, the machinists stood at their posts, working the engines to bell signals.

The inspiration and encouragement, given the firemen and coal passers by the officers in their tours of observation, had much to do with the cheerfulness of the men. They were not cheered by an occasional shout of victory, which broke forth when one of the enemy's vessels seemed to waver under some disablement, or when our Admiral complimented an occasional ship for her superb work. These brave artificers performed their duties with zeal and intelligence, but the strain upon them was intense. At times, the seaman at the engine room telegraph in the conning tower pulled the lever a trifle hard, and the index pointed to the line separating two different signals. The man on watch would have to decide quickly to which order he would respond. His judgment and common sense came into play, but it required great concentration of thought and immediate decision. Breathing an atmosphere partly saturated with steam, for the drain and relief valves had to be opened occasionally to the bilge under such circumstances, these men by their devotion to duty saved the ship. Before the fight was over, one of the engineer officers fell in an apoplectic fit. And after the battle, when the excitement was over, one machinist and two oilers collapsed from the result of their terrible strain in manipulating the engines for nearly five hours.

Within three months, these men passed away, but their work on the day of battle had been glorified by a crown of martyrdom.

DISABLEMENT OF THE *MASSACHUSETTS.*

The enemy seemed to concentrate their fire on the battle ship *Massachusetts*, that name recalling, to the mind of their Admiral, the great part that Massachusetts had played in the history of our country. For a time, it seemed as if this vessel had to contend against a whole division of our opponent's fleet. The skill and courage of the Commander saved her more than once from being rammed and sunk. Two of our battle ships and several cruisers were sent to her assistance, and relief was thus given her, but just before the enemy's squadron had been made to retire, the *Massachusetts* sent up a signal of distress. The continuous shower of shell upon her armor, combined with the recoil of her own guns, had started the main stop valve joint on the starboard boiler of the after compartment. The escaping steam had driven the men from the fire room. One of the water tenders, who had been fitting a new gauge glass near this valve chamber, had been killed by inhaling the steam, and a part of the fire room force, who had entered the bunker, was missing. An engineer officer, who had tried to prevail upon the men to remain in the fire room, had been partially blinded, having groped his way midst the escaping steam to locate the impairment. Until he had found the cause, it had been believed that an auxiliary steam pipe had burst. This officer had been pulled out of the fire room by a machinist, whose accurate knowledge of the fire room passage, had made it possible for him to reach the water tight door leading into the engine room. The men from the other fire room in this compartment had been compelled to leave their station, the leak from the joint continually increasing. Communication with the other boilers had been cut off, but not until the pressure in the boilers of the other compartments had fallen. Brave men finally raised the safety valves, and, eventually, the stop valves were closed from deck. A good percentage of the men, treated that day by the surgeons of the *Massachusetts*, was found in the watch that had to battle with this casualty. The frightful roar of steam through the escape pipes disheartened the ships of our squadron, and once again the *Massachusetts* was made the center of attack. Her gallant captain fell at his post, but the story of his fight is known to every school boy in the land. Like the *Constitution* and the *Hartford*, the *Massachusetts* will ever be regarded as one of our historic ships for the work she did that day.

EFFECT OF THE HEAVY SEA UPON THE SMALL BOATS.

There being considerable sea, the speed of the smaller vessels of both squadrons was materially reduced. The enemy, by having blockading work to do, had quite a number of transports which, at this time, hampered them. Many of their boats put to sea. Followed by the *Olympia*, with her large boiler power, quite a number of these small craft was totally disabled. The heavy sea did not affect the speed of the large cruisers to the extent that it did the smaller craft. And our vessels, with their great boiler power, were not effected to the extent that the enemy was.

EFFICIENT WORK OF THE EMERGENCY WATCH.

The picked men who formed the emergency division did excellent work on all the ships. Comprised as this body was, of men who were resourceful and inventive, they were constantly in demand. The dexterity and skill, shown by some of the boiler-makers in the use of hand tools, astonished and delighted the Commanders; the jamming of the forward turret of the flagship was overcome by the rapidity with which the obstruction was cut out of the gearing. More than one disabled fire main was temporarily repaired by fitting straps over the defective parts. By quickly fitting an alligator wrench to the spindle of its training gear, one of the large guns of the *Indiana* was again made to do service. The after smoke-pipe of the *New York* was kept in place by the ingenuity with which eye bolts were secured to the rim of the upper section.

The official reports of the several Chief Engineers and Executive Officers tell in detail of the incessant calls made upon this Division, and the readiness of resource with which this picked body performed the many services required of them.

EFFICIENCY OF THE TRIPLE-SCREW VESSELS.

The *Columbia* and *Minneapolis*, with their great speed, distinguished themselves that day, and forever silenced their critics. The numerous torpedo boats and torpedo chasers were gradually sunk by the shell of their rapid fire guns. The result of this battle showed that vessels of 7,000 tons, installed as the *Minneapolis* is with a boiler power of 20,000 horses, will in a rough sea make quick work of a nest of small craft, and that the *Pirate* type will play a specially important part in a battle between fleets.

One of the nautical guerrillas, in the shape of a torpedo boat chaser, disabled the starboard screw of the *Minneapolis*. With the two remaining screws, this vessel made over 20 knots at intervals; she was easily steered, for there was comparatively little helm angle, and, disabled as she was, in connection with the *Olympia* and *Columbia*, she did magnificent work, chasing and overhauling the transports of the enemy after battle.

All during the fight, the strain upon the Chief Engineers of the respective ships was beyond description. For years these officers had no power to reward or punish their firemen. The unmanly of the fire room force soon found out, that their comfort and convenience could best be secured by winning the favor of the Executive Officer, rather than doing their duty at their stations.

The duties of the firemen "were of the most arduous and disagreeable nature, very trying to health, temper and discipline. Their management by the engineer officers was often a difficult task even in times of peace."

INSUBORDINATION IN THE FIRE ROOM.

When the stokeholds were closed on one of our ships, and the firemen realized that if any of the crew were to go down in their vessels, there was no chance of escape for them, they insisted upon leaving some doors open, so that there might be some hope of reaching the deck bef[illegible] officers had the do[illegible] leaders of the mu[illegible] derstand that an engineer must have absolute control over his men in action, and that, isolated as he is, he must be ready to assume great responsibilities. The insubordination on this vessel in the fire room, resulting from a vicious system, was the greatest stain upon that ship's good name and fame, and her sinking must be attributed to the demoralization in the fire room, for, if that force had been effective, she would not have been rammed.

CONDITION OF THE ENEMY.

From one of the engineer officers who was attached to the enemy's flag ship, the following facts were gathered concerning the work of their Corps of Naval Engineers:

Even before they left Halifax, trouble had been found aboard two battleships and one of their fastest cruisers with their hydraulic piping. Night and day the mechanics had been at work overhauling the joints. The flanges had been smoothed and, where necessary, caulking of the seams had been carefully done. The entire line had been repeatedly disconnected and, wherever possible, easier bends had been substituted. Vegetable packings woven in a variety of forms had been tried, as well as the cup leather and metallic types. Incessant leaks had occurred, and up to the day the fleet had occupied Provincetown, it had been impossible to move one of the turrets on the speediest battleship; for in repeatedly overhauling this vessel, several of the flanges had been cracked. No one in the fleet had been able to repair the damage, for the flanges had been secured in a special way which required the use of particular machine tools. Several of our own ships had some of the flanges of the hydraulic piping fitted in ways equally hard to repair, but fortunately our ships had been within a few hours reach of repair establishments, where a specialty was made of this kind of work.

These ships had crossed the Atlantic just in time to encounter the equinoctial gales. From the day they took their departure from the Western Islands, until they reached the American coast, they had met continuous bad weather, and it is possible that the turrets and hydraulic outfit had in some way been impaired at the time.

Several pin holes in the pipes had made their appearance, but this weakness had been overcome by fitting eye straps over the defects. Under a pressure of six hundred pounds, a stream would issue from one of the holes, which had velocity enough to cut a person standing in front of it. A single hole was sufficient to imperil the system. Exceeding care had been taken with the cotton rubber packing of the joints, but it was found that, from atmospheric or chemical causes, the material had lacked some of the advantages which it possessed when the plant was installed. It was impossible to prevent the joints from leaking a short time after pressure had been applied. Some trouble had been anticipated with this piping, as, about ten years before, one of their most powerful vessels had met with similar disablement in the Far East.

Had not the enemy had this difficulty to overcome in two of their battle ships, the *Massachusetts* would probably have been sunk after the accident to her stop valve chamber.

Our Admiral was not altogether surprised at this news, for he well knew that it had been found necessary to renew the piping of the *Monterey*, and that experts had to be sent from the Washington gun foundry to overhaul the joints of the *Amphitrite's* hydraulic gun gear after she had been three months in commission.

IMPAIRMENT OF THE FANS.

On one of the ships having a closed fire room, serious results occurred from the stoppage of the fans. The fine dust from the floor plates was carried into the bearings and crank pins of the blower engine, and at one time, three-fourths of the fans were not in use. The repeated bell signals from deck compelled the artificers to give their attention to the working of the main engines. The overhauling of blower engines had therefore to be done very hurriedly. Orders having been received to force the fires, the blowers were speeded up again. Water having been carried over, the result was a breaking down of the plant. It was not long before the vessel's speed was reduced, and this magnificent ship, from which so much was expected, cut a sorry figure in the fight. Better luck was had on those ships having the "closed ash pit system."

The experience acquired in this battle showed that the blower engines should not be made so light that they will not stand hard usage and slight neglect.

VERY INEFFICIENT FIREMEN IN ENEMY'S TRANSPORT SERVICE.

The enemy labored under the great disadvantage of not being able to maintain a sufficient and trained fire-room force. Their stokeholds were filled with firemen and coal passers who were inefficient by reason of their age and inexperience. They were practically boys who had been recruited from a class which had never worked in vitiated atmospheres, and when compelled to duty in the stokehold, heated to a high temperature, they soon collapsed. These youths could not do the work that had been performed by the Chinamen who had formerly done the stoking.

Our Ministers at Pekin and Tokio had urged the respective Governments of China and Japan to forbid their citizens entering the service of the enemy, and this request had been complied with. This seriously crippled their transport service and materially lessened the efficiency of their merchant marine.

The Engineer-in-Chief of the enemy's service had pleaded almost to desperation that the declaration of war be delayed until at least partly trained firemen could be secured for the transports. It was absolutely impossible for him to reason with the officials of the Admiralty. They thought that they knew more about firemen than he did. They told him that by his very nature, training and education he was incapable of looking at matters beyond his department. He was also told that his efficiency, if necessary, must be subordinated to the good of the service. This platitude and truism had no application to his request, but in connection with the slur upon his profession, it was expected to silence him It was a costly error to that great Nation to rebuke this able man, for if his advice had been taken, the result might have been different.

This man knew that the bulk of the great carrying trade of the world had been done in vessels with Chinese firemen, and that if they were suddenly removed, there would be no trained substitutes available.

Of all the steamship companies that enter the ports of the Far East, only three have European firemen, and even these companies have coolies assisting the white stokers. There are over sixty lines of vessels trading with these ports, so that it may be said that in one hemisphere there are practically no ships with an European fire room force. Five-sixths of these lines have Chinese firemen, and some of the stokeholds are so hot that white men cannot work in them. For years the weakness of our enemy in this respect had been known to marine engineers, but their warning had been ignored. The study of the tactics of preceding centuries had a greater charm than the solution of an important engineering question.

"Remove the Chinese from the stokeholds of our vessels and the carrying trade of the Far East passes from our control forever," said an European Marine Superintendent, who had lived over a score of years in China. This man knew that it would take them five years at least, and probably ten, to supplant the Chinese stokers by a trained force of competent firemen. There are men who believe that the task would be impossible, for the Chinese stokers live in heated stokeholds where Europeans would collapse.

The firemen of the transatlantic greyhounds are compelled to lay off at least every third trip; and to keep them up to their work, they are supplied with the most nourishing diet as well as commodious quarters.

These Chinamen had simply to be prevented from entering the Merchant Marine Service of the enemy, and their commerce received a blow which was more than serious.

The Japanese have a full realization of the aid rendered England by the stokers of the Middle Kingdom, and one of the ways the Asiatics are going to secure the commerce of the China Sea is by cutting off this supply.

A distinguished Russian officer told me that in case they ever had trouble with Great Britain, one of the first things to be done would be to drive the Chinese out of the English fire rooms. If no other method could be found, they would declare such men pirates, and hang them upon capture. In this way, he said, we will cripple their transport service and drive much of their commerce from the ocean.

I was also told by an able British editor that the removal of the firemen would so impair the speed of their boats, that the insurance rates would run up so high, that a good percentage of the ships would have to tie to their docks.

This fire room question was a momentous one to our enemy working far from their military base.

SHORE FIREMEN INEFFICIENT AT SEA.

The most skilled firemen had been sent to the war vessels, and this left a comparatively untrained force for the transports.

It was noticed that the firemen who had previously worked around boilers in shore establishments were not efficient men at sea. They were good water tenders and possessed some skill in firing, but the great heat and limited room for working the furnaces seemed to unnerve them. It was almost impossible to make them stand up to their work. On shore, the boiler houses were large, and there was room for all manner of appliances which somewhat lightened their work. The older the shore firemen, the more unsuited they seemed for the work required of them aboard ship.

The experience of the blockading fleet, and particularly the work on the transports, showed the necessity of having some training school for firemen.

Halifax, not being a commercial center, it was found difficult to secure men there to replace any vacancies in the fire rooms of the several vessels.

CONDITION OF ENEMY'S FIREMEN.

From the time our fleet had been sighted, the Admiral of the blockading squadron had hesitated in regard to engaging in battle. There was not a ship in his fleet which had a full fire room force. There is not a modern man-of-war afloat which can do blockading duty for a month, without a good percentage of the firemen breaking down. The men had given way under the intense strain of continuous work and the fear of torpedo attack. Boilers under steam for weeks, and worked irregularly, are bound to leak, and to keep up an engineer's department under such circumstances requires incessant work. It is true that these men had been assisted by mechanics from the repair ships, but the number of men that can be accommodated on such vessels must necessarily be limited.

With each succeeding day the strength of the engineer's force decreased, so far as numbers were concerned, and it was only because the blockade had to be maintained, and that time was diminishing the efficiency of the firemen, that the Admiral of the enemy's fleet consented to meet a squadron which was superior to his own, only so far as the health and completeness of the ships' crews were concerned.

One of the fire rooms, aboard a certain class of vessels in the enemy's service, is known to their stokers as the "slaughter house." If it is so baneful under easy cruising, what will such a stokehold bring in time of war? In one of our types of vessels we have a fire room which is not much better. How can the men be made to work in such a place?

It is said that aboard the *Yang Wei* at the naval fight of Yalu, "down in the boiler room naked coolies shoveled coal for dear life, gin was as free as water to them, and whenever a man lagged, he was urged on with blows from a thick club made of rubber belting. The draft was so intense, that a continuous sheet of flame poured forth from the funnel."

We can't drive our men in this way, but how are we to make them stand up to work that seems beyond their endurance?

Here is the way Admiral Reveillère, of the French Navy, would overcome this difficulty:

"Let not the deck officers scorn to go below in the fire room when the machinery is going at full speed. In time of war, when the engineer officers will be overworked and the firemen exhausted, it will be necessary to order below in front of the fires our strongest apprentices, in order to be able to give chase or to run. The young officers or midshipmen ought to be able to lead them there. There, where there is danger and fatigue, is the post of duty for the officer. Formerly we did not disdain to go out on a yard arm in bad weather. We should now be able to go in front of the fires when it becomes necessary to push the pressure above the limits of the boiler, either to capture or escape from an enemy. Let everybody on board be trained to fire regularly, and every one know how much coal each furnace will burn at the grestest and at usual speed. The lowest boy used formerly to know how much the ship made by the wind or with the wind astern. Our crews have enough pride to attach the same importance to the speed of the engines, and not one of them will, therefore, dislike going below before the fires on the day of a fight, to take the place of the sick or the crippled."

This reads beautifully, but the enemy, with the best fire room force in the world, could not put such desirable recommendations into practice. A fireman is a skilled worker, not a strong laborer, and cannot be replaced so easily.

WEAKNESS OF THE ENEMY'S TRANSPORT SERVICE WHEN FAR FROM ITS BASE.

Heretofore the enemy had been regarded as a nation which had an unrivalled transport service, and one which was supposed to be sufficient for every emergency. Operating three thousand miles from home, and with an alert and aggressive opponent, was a condition quite different from that which had confronted them in previous years. The *Columbia*, *Olympia* and *Minneapolis* had captured so many of these boats, that the protection of the transports was a matter of great concern to the Commander of the enemy's fleet.

It was recalled to mind that the Japanese required 80 transports to carry the same number of men that our enemy had. But the transports of Dai Nippon worked only 400 miles from their base and were practically unmolested in their service. The ships of the Japanese were also coaled by people from shore. The enemy operating off the New England coast had to coal at sea. The Japanese practically did no blockading.

The firemen of many transports broke down under the severe work exacted of them. With crowded decks, they neither had the privileges nor the comforts heretofore given them. Our *Minneapolis*, *Columbus* and *Olympia* had no trouble in capturing the fastest of them. As the transports had not done the work that was expected of them, the enemy's fleet went into battle with more than one vessel lacking a sufficiency of stores and supplies.

DISABLEMENT LIABLE TO OCCUR.

During the action, the engines of the several ships were used intermittently, not only at full speed, half speed and at varying speeds of backing, but at progressing and decreasing speeds ahead. The machinery is built for such work, and with care, should not suffer when subjected to such strains. But, in time of excitement, the men on watch will hear the telegraph signal repeated by startling orders from above, and in order to obey quickly, valves will be suddenly opened. Starting up quickly will cause the boilers to foam and, if water gets in the auxiliary line of steam piping, there is going to be trouble with some of the dependencies of the main engines.

Some of our ships have single engines to drive their circulating pumps, and these are liable to become disabled if water is carried over. The same trouble can be expected from the independent air pump. These dependencies must be placed low in the vessel where they can be easily manipulated, and as separators, traps and such contrivances are at times unreliable, their working will be seriously impaired when water reaches the pipes.

EFFECT OF SHOT AND SHELL.

There is another class of accidents which may happen for which the machinery should not be held responsible. I now refer to accidents caused by shot and shell, by torpedoes and by ramming. A shot or shell in the machinery space, a torpedo under the ship, or a good blow from a ram would probably disable the ship and, in most cases, the only thing to do would be to get out. There are other accidents which may arise from shell bursting over battle gratings. Suppose a shell were to burst in the armored portion of the smoke pipe, or just over the grating, the concussion or force of the blast might easily tear away some of the uptake, and interfere seriously with the draft. Again, should a shell burst over some of the other hatches, which must be open for ventilation, splinters from the shell would come through the gratings and might cut some of the steam pipes, filling the compartment with steam, and disabling a part of the machinery which was supplied by that pipe. It would not require much of a splinter to pierce the main steam pipe. This would disable, or rather might disable, the main engines, depending on whether there was more than one steam pipe and on the seriousness of the accident. These splinters might do other damage, but I do not think they would be likely to do much harm to the larger parts of the machinery.

EFFORT TO DISABLE OUR PROPELLERS.

The position of the propeller renders it liable to accident, and more than one ship was disabled that day from injury to the screw. Floating objects will break the blades and shafts of the propellers, and the machinery, when subjected to unusual shock or strain, may bring about the same result.

Our enemy's Commander-in-Chief expended at least one fast torpedo boat in the effort to disable one or both of the *Iowa's* propellers. A bold attempt was also made, under cover of the smoke, to carry on the bows of a swift boat a wire netting, which it was believed could be entangled in a wing screw of one of our large ships. All through the fight, the disabling of a propeller of our battle ships was a feature of the enemy's strategy. The Admiral believed that any battle ship, with one of her two sets of engines disabled, and carrying a helm angle that materially interfered with her manœuvring powers, was little better than a cripple, so far as offensive work was concerned.

Our Commanders, with their intimate knowledge of the currents off the New England Coast, were able to manœuvre the vessels in such a way that, except in the case of the *Minneapolis*, their propellers were not disabled by the maritime pests in the shape of rapid small craft.

The breaking of a propeller blade in itself may not be a serious casualty. If it is followed by irregular working of the engines and subjecting the machinery to shock, a broken thrust shaft may be the consequence. Losing a blade throws the engine out of balance, and machinery is then subjected to irregular strains. With a heavy sea prevailing, and a propeller in this condition, a fracture of the thrust shaft need not be surprising. Partly submerged objects in a narrow channel may do great damage to the propellers of war vessels by breaking off the end of their blades.

Our Admiral had carefully warned the several Commanders to look out for floating objects, and that the protection of the propellers was a matter of serious importance.

MISTAKE IN HAVING DYNAMOS FAR REMOVED FROM MECHANICS.

That policy of ours, which placed the dynamo rooms as far as possible from the boilers, brought distress to more than one of our vessels. The insulation of the wires is not impaired on other ships by placing the plant within the engine or boiler compartments; and, as we use the best insulated wire that can be purchased, it is fair to presume that we can do as well as other people in this respect. Our ships went into the fight with a long line of piping between the boilers and the dynamo engines. That mysterious force, which can be so easily understood, has its generator in a part of the vessel where the engine force cannot assist in its maintenance, and where skilled mechanics cannot put it in order when disabled. We paid dearly for this work in this battle. Very early in the fight, two of the battle ships had the steam pipes of the dynamo plant disabled by metal splinters. Concussion of striking projectiles, on another ship, started the joints in the long line of piping on the berth deck and, in general, we repeated the performance that took place at the Yalu, where every electrical device was out of order when the contest was over. The enemy had better luck with their electrical plant, for their dynamos and attachments were better protected and nearer the boilers. Their skilled artificers of the engine force supervised and directed the running of their dynamos, as the engines were within reach. Our machinists, being in another compartment, could not assist when called upon for aid. The emergency watch, however, made temporary repairs whenever it was possible to do so.

RESULT OF THE BATTLE.

This lecture simply tells of the responsibilities and duties of the Corps of Naval Engineers. It is not an account of that great naval conflict which was fought off the bold coast of New England, where we gained the great victory which placed the laurel crown upon the brow of the greatest Admiral that America ever produced. Our enemy was vanquished. From Bar Harbor to Block Island the coast was safe. When the story was told across the water, our enemy soon realized that, with the best engineer force of any nation in the world, their steam department had brought their ships to grief.

The disadvantages under which the engineers and firemen of the blockading fleet labored, compared with those of our defense fleet, were too great to be overcome. There were no immediate reliefs to take the place of the sick and exhausted. There were no auxiliary repair stations to overcome casualties. There were not thousands of available laborers ready to coal the ships. There were no peaceful harbors to anchor in during the fury of the gale, or when great repairs were needed. There was a vigilant and aggressive fleet for our enemy to watch, and the defence fleet had at its command, within a few hours, the resources of the best machine shops in the world.

As the battle of the Chatham had been a contest of machines, it was not surprising that we won.

Their engineers and firemen (and there were none better afloat) had simply been used up by the fewness of numbers, the inexperience of many of the firemen, and by excessive work before the battle began. That mighty nation then looked for the cause of the collapse in the motive department of its vessels of war. It was found in a vicious organization which had not done justice to the Engineer and his force of men. Then a structure fell, whose foundation stones were tradition and conservatism; and ever since, in that service, the purple stripe between the bands of gold has received the recognition it justly deserves.

This battle also aroused our Government to the importance of the engineer force on board ship. Countless facts were then forthcoming of the vital necessity of extending the naval engineers' work. It was then realized that on the engineers primarily rests the fighting efficiency of every navy.

A reorganization was effected which was regarded, by those who had been indifferent to the development of machinery in vessels of war, as revolution.

FOURTH LECTURE.

THE WORK OF THE CORPS OF NAVAL ENGINEERS AFTER BATTLE.

" Rejoin my flagship in three weeks," signalled Vice Admiral Ito to the commander of the *Matsu-Shima* as she steamed for Japan after the battle of the Yalu. With moderate steaming this vessel ought to have reached a dockyard in two days. Allowing three days for docking, (which is more than the average time taken in Japan when no repairs are made to the hull or propeller,) and at least two weeks were given for repairs. The only impairment, which seriously interfered with her efficiency as a fighting machine, was the disabling of the controlling valve of her 65-ton gun. The other repairs were scattered and admitted of a large force to work upon them.

The *Matsu-Shima* will ever be regarded by the Japanese as the historic ship of the Yalu, and for which Admiral Ito had a special love, for upon her decks he had won his great victory. It was upon the military mast of this vessel that the kite flew, which brought so much happiness to the sailors of Dai Nipon's fleet, and which was regarded as the harbinger of success. There were other good reasons why the Admiral was anxious to have the vessel join him at a very early day and, in giving three weeks for repairs, it is fair to presume that it could not have been done in less time.

This will give some idea of the delay experienced in making repairs to a modern cruiser. The workmanship of the several parts is of the highest order, and unusual care is taken in assembling them together. To withstand the pressure and strain which the parts are subjected to, the best of material must be used, and the design must have much to commend it.

Many people have written of the strategy and tactics of a fleet in the piping times of peace and fair weather cruising. In one of the publications of the U. S. Naval Institute, Fleet Engineer George Quick of the Royal Navy writes of "The Organization of the Naval Engineer Forces." He particularly dwells upon their duties "*in the hour of battle and the week afterwards.*" This earnest and talented officer has contributed one of the best and most important monographs that has ever been issued by a service journal. And yet his article stands out almost alone, as the one contribution which has been unnoticed and not deemed worthy of discussion.

His views are sound, and our great land will yet profit by his warning, for he tells us things we should all know. He writes with an earnest affection for our Navy, although in a service which may one day meet us in battle. But he assails too strongly, although very kindly, the traditions of the past, and therefore his able article has been unnoticed.

A TRIFLING IMPAIRMENT OF MACHINERY MAY DISABLE BATTLE SHIPS.

In speaking of the impairment aboard war vessels, Mr. Quick says:

"Let me give one small example of those things which are occurring every day in all navies.

"On the 13th of July, 1891, during target practice on board H.M.S. *Trafalgar*, the locking bolt of the after turret was broken, and the turret was practically useless for three days, although the ship's artificers worked night and day at the repairs. Here we see one-half of the fighting power of a ship of 11,940 tons and 12,000 horse power disabled for three days by the breaking of a single bolt. But if the breaking of a single locking bolt disables the half of the fighting power of a 12,000 ton iron clad, and the repair of that defect requires the labor of the whole of the ship's artificers for three days and nights, what may we expect when a ship has been engaged for an hour with an enemy of equal fighting power? How many mechanics will be required to repair damages after one heavy shell has exploded inboard? This question is easy to ask, but not so easy to answer."

With such facts before us, it must be recognized that the breakdown of the engineering department during action means the total loss of the ship, or its usefulness for offensive work completely destroyed.

If any part of a shackle is defective, the result may be as serious as the breaking of the strongest link in the chain. The failure of the piston rod to have a well rounded fillet on its shoulder, may cause the same wrecking of cylinders that occurred on the *Ericsson.* The blowing out of a single tube may disable a boiler and interfere with the efficient working of others.

NECESSITY OF HAVING RELIABLE MACHINERY.

The distinguished naval architect, Mr. W. H. White, in a paper read before the Royal Society, expressed the opinion that modern ships will not stand more than one well-contested engagement, and many naval officers share this view. Thus declares the "Army and Navy Gazette," less than a year ago, and after the battle of the Yalu:

" To prepare for such a day, our vessels should be designed accordingly. There should be no stinting of weights in the engine room. Rather than do this, decrease the width of the armor belt and cut down the bunker supply. A leaky boiler and a poor condenser on a cruiser will reduce the steaming radius more than the removal of a hundred tons of coal.

The Engineer-in-Chief of the Navy, in his uncompromising struggle against the reduction of machinery weights, is fighting the battle of our Commanding Officers rather than that of the Chief Engineer, and upon this question, the influence of this college should be exerted in supporting him.

Would that policy commend itself which would cut down the weight of a gun and its mount about 10 per cent., after the experts had carefully submitted estimates?

NECESSITY FOR PROVIDING FOR REPAIRS.

Naval experts have now commenced to realize the necessity of making provision for executing repairs more promptly. The equipment of floating workshops is an outcome of the repeated breakdowns of war vessels, due to crowded machinery with excessively light parts. That inexcusable fad, to make lighter machinery than one's neighbor, is now going out of fashion, although we can rejoice in the fact that the custom did not have a strong foothold in America. It is no longer good form to be an advocate of a half dozen kinds of motors aboard a single ship, for immense repair bills and disabled machines are the sequence of having steam, anhydrous ammonia, compressed air, hydraulic accumulators and dynamos aboard the same vessel. The full measure of the specialist has been taken, and most of his projected machines now do not get beyond the designing room, for the tendency is to simplify the auxiliaries and give each one more room and increased weight for its installation. This makes the several parts more accessible for overhauling and decreases their liability to become impaired. In designing machinery for war vessels, facility for examination and repairs is going to be considered a greater factor than it has been heretofore. That vessel is no longer regarded as useful which is constantly under repairs.

In order to be prepared for battle and to quickly recover from its effects, war vessels must be constructed for continuous service and not for trial trips. In building the several types, the machinery should be made sufficiently strong, and more room should be given for its installation, which space could be found by taking part of the quarters of the officers. If this were done, the vessels would be more serviceable in action, and there should be fewer repairs to make after battle was over.

In the upbuilding of a navy, therefore, types and classes of vessels should be constructed; there should not be an aggregation of individual ships, which embody the ideas of earnest specialists, but which have no relation to a comprehensive plan and which require months to repair when disabled.

There are many strategic reasons why there should be such classes, but from an engineer's standpoint the following are sufficient:

(*a*) Defects of design in the machinery would sooner be discovered and overcome.

(*b*) With men thoroughly acquainted with the fittings of several ships, it would be possible to make several changes in the personnel by which the engineer's force could quickly be reorganized after battle.

(*c*) The best method of maintaining the efficiency of the department, making necessary repairs and doing the general overhauling, could be developed.

(*d*) From several permanently-disabled vessels, all but one might be rendered serviceable after battle, if the impairment was in the machinery.

(*e*) Fleet drills and manœuvres could be carried on with more efficiency. Reliable uniform speeds could be secured more easily and rapidly. And the Admiral in command could get better work from his fleet, for his strategy and tactics could more easily be carried out.

It is true that the individual commander, by his skill, courage, and strategy, may render great service to the State and bring glory and renown to his career. The destiny of nations, however, will be decided by battles between fleets and not engagements between ships.

This lecture, will, therefore, treat of the work to be done after battle with a fleet composed of types of vessels, rather than tell of the ingenuity of special individuals. It will deal with this particular problem, as this is about the real condition of affairs.

It requires no great imaginative powers to believe that the rapid repair of the vessels of a fleet will increase the importance of a victory or weaken the force of defeat. And upon the professional skill and directing talent of the Naval Engineer will depend the success of this work.

WHERE REPAIRS SHOULD BE MADE AFTER BATTLE.

A few days before the enemy had been attacked, the question of *where* and *how* the repairs could be made, had been carefully considered by the Engineer-in-Chief, the Admiral in command of the Defense Fleet, and the Secretary of the Navy. Should the vessels be sent to a Navy Yard? *How* should they be repaired? These important questions were carefully inquired into.

It was determined not to send any vessels to a Navy Yard, except those which required docking, for the following reasons:

Time was of the utmost importance in getting the fleet ready for sea again, and the history of the Navy Yards, in previous emergencies, showed that work could not be expedited there. Industrial engineering methods are incompatible with official routine, and a vessel once within the grasp of a military clerical system had to submit to vexatious delays. There were many other good reasons for sending the fleet elsewhere than to Navy Yards.

Until the conflict was finished, it would be impossible to tell how extensive the repairs might be, and it was almost a certainty that private firms would be called upon for assistance. These establishments could not work in co-operation with naval plants. Their methods were altogether different, and there could not be harmonious and efficient commingling of their forces. This was unhesitatingly told the Secretary of the Navy.

Another fact, which influenced the decision, was the time that it had taken the North Atlantic Fleet the previous year to overhaul at the Navy Yard, and the fraction of that time which it had taken sister ships on other stations to do the same general work. The Engineer-in-Chief showed so conclusively that the repairs could be made more promptly in Narragansett Bay, that his recommendation was endorsed by the Admiral of the fleet.

Considerable preparation had therefore been made for the reception of the vessels, and a strong corps of naval engineers and scientific mechanical experts had organized the various auxiliary repair stations and machine shops into one great plant, where all worked harmoniously in common.

Except the vessels which required repairs to their hulls and propellers, our victorious fleet steamed to Narragansett Bay and the several ships immediately commenced making repairs.

Nearly every town and city on Narragansett Bay is within two hours of Boston or Worcester by rail. Within three hours, nearly every manufacturing city in the Blackstone and Connecticut Valleys can be reached. The forts at Newport would deny an enemy entrance to the Bay; and innumerable small boats could communicate between the fleet and Providence with impunity. Within two weeks, a solid built-up crankshaft could be constructed in Providence for a small cruiser. Time will not permit me to tell of the advantages this Bay would have for repairing the machinery and fittings of a fleet.

ENGINEER-IN-CHIEF MELVILLE MADE DIRECTOR-GENERAL OF REPAIRS.

From the auxiliary naval repair stations, from the manufacturing cities and towns along the Blackstone and Connecticut Rivers and from New York and its environs, thousands of the best mechanics in the world were sent to the vessels. Engineer-in-Chief Melville, by order of the President, was made the Director-General of Repairs. This appointment was received with unusual favor by the country, for one of the enemy's greatest engineering authorities had declared, that Engineer-in-Chief Melville was the ablest Chief of any Manufacturing or Constructing Bureau that America ever had in her Naval Department. Our people remembered that, even as a boy, he had been a leader, for before he was eighteen years of age he had designed and constructed a breech-loading gun; that during the Civil War he had rendered important service, for he had originated the idea of a protective deck; that he had been particularly commended for his skill, ability, and readiness of resource on board the ill-fated *Jeannette*; that he had shown himself great in his unparallelled search for De Long in the Lena Delta; that he had been greater still in the rehabilitation of the Navy as Chief of the Bureau of Steam Engineering and as Engineer-in-Chief of the Navy. And the Nation believed that his highest greatness could be reached, if his energy and matchless engineering talents were directed to the restoration of a crippled fleet and the captured cruisers and battleships.

HOW THE REPAIRS WERE MADE.

The repair ships *Fulton* and *Corliss* reached the fleet within a few hours. Additional telegraph and telephone lines had been established within a day, the military telegraph engineers having put up lines in a manner that had astonished even the officials of the Western Union Telegraph Company. Directed by the genius of able electricians who had volunteered their services, there had been established in an incredibly short space of time, as a gift from the great electrical combine, a powerful electric light plant, which permitted the prosecution of the work at night. From all along the coast, the scouts and Sound steamers brought tools and supplies. Under the inspiration of several Fleet Engineers, and such men as D. H. Thompson and Gardner Sims, of Providence; S. B. Whiting and Asa Mattice, of Boston; Francis A. Pratt, of Hartford; C. W. Moore and Horace Lee, of New York; D. A. Tompkins, of Charlotte, N. C.; John Fritz, of Bethlehem; Coleman Sellers and J. J. de Kinder, of Philadelphia; and George W. Dickie, of San Francisco, Engineer-in-Chief Melville soon brought order out of chaos. There was not a machine shop in New England whose proprietor was not willing to turn his establishment into a naval repair station. Providence and Pawtucket, with their thousands of skilled mechanics, did the bulk of the work. Every small order was duplicated at different shops, and this was found an excellent method of pushing work. Many of the torpedo boats were repaired at Bristol, the genius of a Herreshoff personally superintending the direction and scope of the work.

REGRET THAT NO NAVAL CONSTRUCTOR HAD BEEN IN THE BATTLE.

During the progress of the repairs, it was greatly regretted that not a single Naval Constructor had been aboard any of our vessels participating in the battle. The Executive Officer, who was in charge of the Construction Department, had important duties to perform in assisting the Captain to fight the ship. Many questions relating to the principles of naval architecture had, therefore, to remain unanswered at the time.

The enemy, however, had naval constructors aboard several of their large ships, and they furnished valuable information to their naval authorities, which would have been of inestimable benefit to the Engineer-in-Chief, could it have been secured during the few days following the battle.

The mistake in not sending the constructors to sea having been recognized; one was ordered to each of the large vessels. The same success, which had attended the detailing of the ordnance and engineer designer to sea-going ships, was afterwards found in the case of the constructors. Particular improvements were noticed in the ventilating arrangements, in the improved facilities for coaling ships, hoisting boats, cleaning bilges, rigging gangway ladders, and in the location of cargo ports.

Not having seen anything of the fight, many questions relating to the repairs, which should have come within the province of the Constructor, had to be solved by the Naval Engineer, whose experience in the battle made him competent to decide intelligently.

SPECIAL WORK OF THE CHIEF ENGINEERS.

The great work of the chief engineers and the assistants of the several ships was to overlook the repairs and suggest remedies and improvements. Their services at such a time were too valuable to give their attention to any single impairment. The limited room for working, and the many local difficulties to be overcome in making repairs and doing general overhauling, astonished the mechanical engineers from shore. They realized then, more fully than ever before, the responsibility connected with the efficient maintenance of the motive department of a war vessel.

Vise benches, drilling and punching machines, anvils and forges, made a sad plight of what had once been snowy decks. No injury was done to them, however, as they had been covered by light flooring. To see the work done on these decks with hand tools, reminded many of the time when there were but few machine tools, and when it was said that such firms as Fletcher, Harrison & Co., had built the machinery of the North River steamboats on the sidewalks of New York. Bed plates and valve seats were faced in those days by experts with hand chisels, and equally as good work was done on many of the ships of the fleet.

Loyally and patiently the shore mechanics worked. Within the cramped quarters of the back connections, the boiler makers fitted patches. For hours the machinists strained themselves in scraping the linings of valve chests. The fitters, at the peril of their lives, removed and replaced overhead piping. Conscientious men crawled under cylinders and boilers to clean bilges and keep the boiler shells in a state of efficiency.

EXCELLENT WORK OF THE TRIPLE-SCREW SHIPS AFTER BATTLE.

For three days after the battle, and while the other vessels of the fleet were being repaired, the triple-screw ships *Columbia* and *Minneapolis* were cruising off the New England coast, capturing transports and scouts, which had been sent from Halifax and which had no knowledge of the battle. Even with her disabled starboard screw, the *Minneapolis* did brilliant work. From the time a prize was sighted until its capture, the *Columbia* had no difficulty in steaming 21.5 knots; the *Minneapolis*, with her two engines, maintained a speed of nearly 19 knots.

The remarks of Admiral Fournier, before the French Special Parliamentary Commission of Inquiry, undoubtedly reflect the views of our people in regard to these triple-screw vessels. The Admiral is thus officially reported: "Wisdom should order us to abandon, as soon as possible, the construction of these ruinous mastodon battleships. The type of war vessel most useful is that of the triple-screw vessel *Dupuy-de-Lôme*."

He also said: "The naval battle of the Yalu proved the truth of the following conclusions:

"1st. The capital advantage of speed.

"2d. The superiority of rapid fire guns over heavy guns.

"3d. The uselessness of heavy armor.

"We should insist upon *speed*, which is the weapon, par excellence, of modern war ships."

FRENCH PRAISE FOR THE TRIPLE-SCREW CRUISER.

The most glowing, and at the same time the most disinterested praise of the *Columbia* was published in "La Patrie," of Paris, on July 12, under the signature of its editor-in-chief, Mr. Lucien Millevoye. He was formerly a Deputy in the French Chamber, where his speeches and assiduity to his legislative duties increased the popularity he already enjoyed as a patriotic and clear-headed statesman. "The fetes of Kiel," says M. Millevoye, "will have, perhaps, as an unexpected consequence, a renovation of the French Navy. Do you know what our sailors have admired especially in the German waters? It was not the pomp displayed by William III, to dazzle them; it was neither the golden eagle of the imperial helmet nor the theatrical show of German power.

"What has struck France and all Europe with surprise, mixed with fright, is the speed of one of the vessels of the American fleet. The cruiser *Columbia* has manœuvred before all the congregated squadrons with marvellous agility. This is, indeed, the great war instrument of the naval fights of the future. What a strength in the hands of the hardy captains of the sea! Maritime war will be greatly changed by it. That vessel, the *Columbia*, will be able to accept or refuse combat, according to its wishes. It will thunder forth shot and shell, or run away at will. It can, with impunity, cover the surface of the ocean with ruins and wrecks, or laugh at the avengers sent to pursue it. The European Nation which would have the foresight to create a large number of those terrible cruisers would be unassailable, invulnerable and invincible."

NECESSITY OF KEEPING SHIPS ON AN EVEN KEEL.

One of the lessons impressively taught during the progress of the battle, and which caused certain work to be done during the course of the repairs, was this: That keeping ships on an even keel may have an important bearing upon the efficiency of a vessel in action. There are several causes which may list a ship quickly, and unless special provision is made to overcome such accidents, it may be a question of hours before the vessel can be put on an even keel. A list of ten degrees would expose the plates below the armor, and in this way a battleship might be sunk by the rapid-fire gun of a torpedo chaser, or a gun boat. Anything happening to either boilers or bunkers on one side might cause the list. There are several causes which might make it impossible to use coal equally from both sides of a vessel. Leaky tubes, the blowing out of a rivet, the breaking of some attachment to the shell, may all cause the water to run out of a boiler. The impact of the heaviest shell upon the side armor may start the joints, or rupture the steam and water piping, and boilers will undoubtedly be disabled in this way. Trimming tanks being a necessity, they were so placed that they were under the control of the Chief Engineer. They were connected to the main circulating and other pumps, so that they could be quickly emptied or filled. Every longitudinal bulkhead had some contrivance, whereby communication could be instantly established between the compartments which they separated.

CONDITION OF TORPEDO BOATS AFTER BATTLE.

An examination of the captured torpedo boats showed that the boilers and engines had been forced to their utmost. A few of the grate bars had been melted down, and the tubes leaked considerably from the forcing which they had been subjected to. In the efforts of the boats to escape, the working pressure had been exceeded, and the blowers had been run at an excessive speed.

Driving these small boats into a heavy sea had subjected the engines to shock. The anti-attrition metal had run out of one of the crank pins and several bearings. Some of the discharge valves of the air pump had carried away, which had greatly impaired the efficiency of the condensers.

The condition of the engine and fire room force was pitiable. For nearly a month these men had been under a great strain, both physical and mental. The long trip from Halifax had severely taxed them and, after reaching the Massachusetts coast, their work was not lessened, for the boats were kept on the go constantly in doing messenger service.

The character of the work performed in the engine and fire room of such boats has been told by Mr. John I. Thornycroft, who is the peer of any builder in the world of such craft.

Personal and financial reasons would prompt him to declare that this work was within the ability of the average man, but Mr. Thornycroft speaks plainly to those purchasing boats from him.

WORK OF FIREMEN AND MACHINISTS ON TORPEDO BOATS.

In a recently delivered lecture on torpedo boat destroyers, Mr. Thornycroft referred to the excessive work performed in the engine room. A portion of his remarks, taken from "The Engineer," London, are here given:

"Speaking of the firing, he said the stokers have to exert themselves much more than when firing the ordinary slow working boiler, for when the boat is running at full speed, if the crew is divided into two watches, it would mean that each man must stoke about 600 indicated horse-power of boiler, which is many times the ordinary rate of working and necessarily requires very good men. Again, as it is important to run the engines very fast, it may be interesting to consider how the artificers in charge of them are taxed by this necessity, and compare the running of torpedo boat engines with the engines that were used in the first steam vessels, which made few revolutions in a minute, examples of which are still to be found in tug boats, for which they are suitable.

"If we turn from the comfortable working heavy engine of the tug or river boats to the high speed torpedo boat engine working at its highest power, we then note that the sound in the engine room is confused by the addition of a number of auxiliary engines, each adding their own peculiar series of sounds to the noise of at least three cylinders of the main engine, and all these engines making a confusion which is further complicated by the fact that the auxiliary engines in their rate of working keep no constant ratio to each other or the main engines; they may be considered as part of an orchestra having a separate conductor for each instrument. Now take the next important sense for the engine driver, feeling. The engines are revolving, say

400 revolutions in a minute, and the important moving parts must be touched by the fingers and any change of temperature detected promptly. If this is not done, heating may ensue, which may oblige the engines to be stopped. In this rapid working, the eye is even put to a great disadvantage. The motion is so rapid that no particular position of any working part can be assigned to it, while spray of water and oil is thrown in the eyes and the vision temporarily impaired. However, this description only applies to running at the highest speed.

"At full power the firing scarcely ever ceases, and the forced draft gives such a high temperature in the furnaces as to render the light blinding and painful to the eyes, making the use of colored glass necessary to protect the eyes when examining the furnace to see in what part the fuel is most required. The space for stoking is limited, and the coal bunkers being small, cannot afford convenient room for the coal being rapidly trimmed from them. The very large amount of air passing though the stokehold causes coal dust to be carried about so as to be most unpleasant. In all this dust and hurry the water level and steam pressure must be attentively watched, and we owe much to our stokers for performing these duties, which are of the first importance for the speed and safety of the boat."

CHANGES MADE IN TORPEDO BOATS.

In writing unofficially, the Naval Engineer Inspector of the *Ericsson* made some excellent suggestions in regard to the design and construction of torpedo boats and their machinery. In view of the fact that something sad is always happening to such boats of every nation, his views were carried out in repairing the boats which took part in the battle. His ideas upon the subject, strengthened by personal experience during the accident to the *Ericsson*, were as follows :

1. In designing torpedo boat machinery, the great risk to men below should be uppermost in mind. The great watchword should be, the least possible number of pipes. It would be better to dispense with pipes that could only be used in a remote contingency. No piping should be installed which does

not directly influence the speed. In short, one pipe for many services, not many pipes for one service. The pass-over steam pipe on the *Ericsson* had never been used during the twelve trial trips.

2. On the steam pipes from the boilers, on the engine room side of each fire room bulkhead, there should be fitted a butterfly valve to be worked from deck; a man to be on watch with orders to throw down the lever on the instant of an explosion. No time was wasted in shutting the *Ericsson's* valves, yet the time consumed in doing so was appreciable.

3. The necessity of an open hatch over the whole length of engine room should be appreciated and provided for. The structural strength necessary should be given by cross beams; a cover, to be fitted when necessary, could always be carried, and the hatch made strong enough to withstand the shock from any sea. Objection might be made, but the lives of men must be of more consideration than inexcusable precedent. A plate at the forward end of the engine room was off; size two feet ten inches by four feet six inches. The course of the steam was directly up and forward, and much came through this opening. Had this plate been on, matters would have been worse. Had there been a complete open hatch, matters would have been much better.

4. The great danger from explosion, besides scalding, is the inhalation of steam. The old-time rule in case of an explosion is to get flat down and grope out. Hence, air passages or holes should be provided for, which, in case of an explosion, could be immediately opened from deck, thus allowing the whole volume of air from the fire room blowers to be sent along the engine room floor plates. The broken pipe will always be high up, and the great volume of air suddenly thrown in at the bottom of the engine room, would unquestionably be of benefit to men fighting for their lives. This idea, in connection with the open hatch, must appeal to everybody.

5. The form of ladders and their location in the boat should be a subject of great thought and care. They should be fitted in the most available space for reaching the deck.

DANGER OF AN INSUFFICIENT NUMBER OF ENGINEERS.

The error of that policy, which has permitted the best machinery in the world to be neglected by having an inadequate force of naval engineers, was soon evident. The percentage of engineers who had become incapacitated, or had gone down in their ships, was greater than that in any other Corps.

The intense heat of the department, the strain of controlling and directing men who were worn out with toil, the shattering of their constitutions by the impact of shell upon the side armor, and the concentration of thought in overcoming impairments and casualties, had played havoc with the commissioned officers of the engineer's force. The few engineers, who had been on duty on shore to supervise important work, were sent to the fleet as the reliefs of those who had been exhausted.

Exceeding difficulty was found in making up the engineer's complement. It was only done after the passage of special laws, which permitted the Engineer to give the full measure of his services to the Government.

AN ENGLISH NAVAL ENGINEER WRITES UPON THIS SUBJECT.

"The number of engineer officers has been cut down very low in the British Navy and still lower in the U. S. Navy. I say they have been cut down dangerously low, because in war times a very slight accident may disable the two or three engineer officers and leave the engineer department entirely headless."

VITAL NECESSITY OF REPAIRING QUICKLY.

It is impossible to overestimate the importance of the speedy repair of the machinery of ships of war after an action, for the gaining of only a few hours, in effecting repairs after battle, may decide most important naval operations following upon either a slight or severe engagement.

It is not a good argument to say that our ships will carry as many artificers or mechanics as foreign ships, and that consequently there is no need to increase the staff of mechanics on board our ships. For if two similar ships engage, and each reviolating regulations. Vexatious delays occurred in securing and handling material, and altogether the experience with the floating workshop was not a success.

It was afterward said that our enemy found them very useful in their fleet operations, under conditions where time was not a factor in the matter.

The repair ship was designed at a time when it was believed that vessels could be self-sustaining in regard to repairs. Time was not regarded as such a supreme factor as it is now known to be. They may be useful for a blockading fleet; as store-ships they are valuable even to a defense fleet.

DIFFICULTY OF REORGANIZING THE ENGINEER'S FORCE AFTER BATTLE.

One of the important questions that arose after the battle was the reorganization of the engine and fireroom watches. On every steamer afloat there is some special trouble, some machine or valve, either in the engine or fire room, which requires special skill or knowledge on the part of some one to overcome or attend. The failure of this auxiliary to work may have an important effect upon the efficiency of the main engines. There are some things which cannot be told; they must be acquired gradually by experience. If it were fully realized how skillful, resourceful and patient a good water tender should be, these men would receive more consideration than is now accorded them. If it should be our policy to use water tube boilers, then the duties of the water tender will require an even more efficient man for this work than in the past.

From the deck force, men may be found to relieve the second class firemen and coal passers; but the machinists, boiler makers, coppersmiths, oilers, water tenders and first class firemen can not be secured from the seaman contingent. That day has passed when the average oiler could relieve a machinist. On a modern war vessel, a boiler maker might make a whole cruise without doing any work in the engine room.

So long as we act upon the defensive and are within a day's reach of New York, deficiencies in the engineer's force may be made up.

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The sting of a defeat might be removed by a defense fleet which made speedy repairs, for, with the aid of workmen from shore, the ships might be put in readiness so quickly that the blockading ships could again be attacked before repairs could be effected by the limited number of overworked machinists on board those vessels.

The New England coast, although it would be a rich prize for a hostile fleet, has elements of strength in its manufacturing establishments which may play an important part in a naval conflict.

AN ENGINEER'S WAR SHIP.

And when the rewards were distributed to those who had rendered service to the fleet, a strong public sentiment demanded that the Director-General of Repairs and the Fleet Engineer be signally honored. These men then said, that as a grateful country had recognized their knowledge of the requirements of a modern war vessel and fleet, that they be permitted to build what should be known to all the world as an Engineer's ideal ship of war. It would be one that would do the work which was expected of her.

Upon this subject the greatest engineering paper in the world had thus spoken: " Miles of letter press have been printed and published and read and discussed concerning the construction and qualities of ships of war. We cannot call to mind that any of these disquisitions, or treatises, or papers, or books have emanated exclusively from the brains of Engineers. Of course, without the aid of the Engineer the modern war ship could have no existence. But hitherto he has always taken a second place. He has been told to do this, that and the other thing, and he has gone and done it; but little deference has been paid to any of his rare expressions of opinion. He has been told that naval matters are too hard for him, and that his true function consists in accomplishing the tasks set for him and asking no questions. He is shown, for example, a very limited space on certain plans, and told to put engines and boilers into it, which shall develop 10,000 horse power or some other trifle of that nature, but he is not allowed to suggest that if he had a freer hand he could produce a better speed result, let us say, for less power. He is told that a gun is to be worked in a particular way and that he must have the machinery for so working it, but he is not permitted to point out that the thing permits of being done in another way. He is not snubbed, exactly, but he has been taught to keep his own place and stand, hat in hand, when the naval architect, the artillerist and the sailor pass by.

"Considering how very important is the part played in a compulsory disjointed fashion by the Engineer, we venture to think that he has not been treated quite in the way that he deserves, and we go so far as to ask, is it not about time that the Engineer took the initiative and, reversing the normal practice, employed the Naval Architect and the Artillerist to carry out his designs? We hold that there can be but one sound answer to this question, and it may not be unprofitable to consider what way the Engineer would probably go to work.

"It goes without saying that he would come to the task of designing a fighting ship with a very fair knowledge of what has already been done, and with a mind quite free from prejudice. His first endeavor would be to produce an honest ship, a vessel quite free from shams of all kinds. He will be moderate in his promises, but then they will certainly be kept. As to the shape of the hull and the lines, these must be settled by the Naval Architect, acting under the general instructions of the Engineer.

"It would be clearly understood that the speed settled upon would be the true speed of the ship, and not a fancy result got on a four hours' run with picked coal and selected stokers.

"There would always be precisely similar vessels cruising in company. They would be as much alike as three Martini-Henry rifles. Every part of each would be interchangeable with any other of the three, and as the sea speeds of all would be the same, there would be no waiting for the slowest, and they could always keep in company, save in the wildest weather.

"In one word, the Engineer's war ship would be less of a scientific museum and more of a floating gun carriage. Her claims would be modest, but what she promised to do she could do. The story told by past naval manœuvres goes to show that the promises of the modern war ship are seldom kept, and this simply because more is attempted than the wit of man can carry out."

When the Engineer's ship of war was finished, it was observed that she could be coaled quickly and steered more readily and reliably. She could steam faster for a protracted period because sufficient weight had been allowed to install reliable auxiliaries. Her bilges were accessible for cleaning. Considerable judgment had been exercised in providing for a system of ventilating the compartments. The fire main was a reliable one, and it was not impaired by numerous sharp angles and bends. The quarters of the officers were cut down, but the crew were more comfortable and contented.

In case it was found necessary to abandon the ship, there were enough boats to carry the entire ship's company, and these boats were of such a character that they could live in a sea way.

There was something else than an obsolete and ill continued system of ladders and approaches to the hatches.

A simple and efficient way of battening down had been fitted.

The electric light plant was installed near the boilers and where it could receive the care and supervision of capable mechanics.

It was the production of a sea-going expert, not the creation of a theoretical scientist.

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"Technical Education in the South."

"Detail of Naval Engineers to Scientific Institutions South."

Reprinted from
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Baltimore.

Technical Education in the South.

[From MANUFACTURERS' RECORD, September 20, 1895.]

In a very carefully-prepared address before the American Society of Mechanical Engineers, Dr. R. H. Thurston, director of Sibley College of Mechanical Arts of Cornell University, gave a masterly presentation of the condition of technical education in the United States. He reviews the work of the several scientific institutions, tells of their necessity to America and thus predicts of the future:

> Another point to which I have not alluded in this paper is yet of enormous importance, and I desire to say a word in regard to it here, especially as there are present many men greatly interested in this work. It will be observed that the independent universities, colleges and schools are having continually harder and harder times. The State universities, on the other hand, as a rule are enjoying better times, especially in the West. The reason for this difference is not competition, but the fact that in many schools the operating expenses must be defrayed by tuition fees, while in many other schools the income derived from investments has supported them, and still others are supported by the State. The Rensselaer Polytechnic Institute, for instance, is supported almost entirely by tuition fees. The Eastern universities are mainly supported by invested capital, but during the last few years the rate of income on investments has been steadily decreasing, and it is very certain that it must go on decreasing, and that those institutions which are now dependent upon income from invested capital must expect to see their financial support slipping away from them, and those dependent upon tuition fees are finding the rivalry of other schools reducing the rates. It finally comes to this—that the States must ultimately be looked to to support all classes of schools, if all classes are to succeed. This is a phase of change that we now plainly see going on. It is thus necessary that everyone who has any power in this matter should do what he can to secure stronger support for schools depending upon tuition fees, and in other cases endeavor to find a way to interest the legislatures of the States and to secure from them that effective and permanent support without which our whole great technical system of education must eventually fall. This seems to me the most serious cloud upon the outlook for popular and technical education in the future. Education is becoming more and more costly, and the difficulties in the way of supplying it are of the gravest. It costs at least $300 a year to instruct each student, while the tuition fees are usually low and rarely exceed $200 in any case. Those who have sufficient interest and sufficient breadth of view to see what must be done for the future may look to this as being a line on which they may do especially helpful work, if they can accomplish anything at all.

The prediction of Professor Thurston must, therefore, command the attention of all interested in technical education. The South should give special consideration to his warning, for her scientific colleges are maintained with limited State aid and light tuition fees. It will, therefore, require ability of the highest order to bring the colleges of mechanical arts of the South on an equality with the technical schools of the North, for the latter institutions are more heavily endowed, and also receive greater assistance from their State legislatures. Their revenue from tuition fees also is far greater.

If necessary, the South must make great sacrifices to maintain the technical colleges, for her industrial development will be greatly influenced by the success of such institutions.

To secure a full measure of prosperity the industrial plants between Maryland and Texas must be managed by native-superintendents. And this personnel cannot be secured in the South until her scientific laboratories are put upon a plane which command the respect of technical experts.

So long as the South fails to provide the best scientific training for her youth will she fail to secure the best results from her increasing industrial growth. The South must face the question whether her own youth shall receive the full benefit of the many opportunities for experts, or whether to a great extent they shall be "the hewers of wood and the drawers of water" for others.

In order to make the technical schools of the South self-supporting, an annual tuition fee of at least $150 would be required, no matter how large the attendance of pupils, for a large number of schools necessitates expensive laboratories and classrooms. and it is almost a truism that the greater the attendance the greater the expense to the individual undergraduate. Some assert that it will be impossible for any technical school in the

South to exist which would attempt to maintain itself with tuition fees.

The land-grant colleges, with the assistance of the three separate funds contributed by the national government, will undoubtedly manage to struggle along. Only a small part of this revenue can be used for technical instruction and development. Other aid must, therefore, be rendered these colleges in order to permit them to furnish scientific engineers to the States environing them.

It, therefore, seems inevitable that increased national or State aid must be given them. That the national Congress will vote a direct increased appropriation seems improbable. A few of the richer and progressive States may provide generous appropriations, but of necessity such action must be sporadic and invite hostile and bitter criticism.

The only immediate help to the Southern technical schools within sight is the indirect aid of the national government. This indirect aid may be secured by reason of the calamity that overhangs the navy in having an insufficient number of engineer officers graduated each year from the Naval Academy.

Commodore Melville, engineer-in-chief of the navy, has sounded a note of warning, and has repeatedly and officially declared that our magnificent new war vessels have not a sufficient number of trained naval engineers to properly look out for them. The Naval Academy has not even supplied a sufficient number of cadet engineers to fill the vacancies in the corps caused by casualties and retirements. The few engineers now in the navy are overworked, and the alarming number of breakdowns in the personnel during the past three years show how arduous their duties are. This corps must be increased, or ruin awaits the machinery of our cruisers and battleships.

Paradoxical as it may seem, the wants of the navy and the technical colleges can be secured by the passage of a measure which has already received a unanimous favorable report from a United States Senate naval committee. It will be introduced again this winter, and will be championed by men who will see that a direct vote upon its merits is secured, so that its friends and enemies may be placed upon record.

The land-grant colleges, in connection with other leading scientific institutions, propose, if possible, to see that a law is passed which shall embody the recommendations made by the engineer-in-chief in one of his annual reports, wherein he says:

> While upon the subject of education I call attention to what I believe to be highly desirable, viz, the repeal of the law limiting appointments in the engineer corps to graduates of the Naval Academy. The great technical schools of the country are turning out every year large numbers of young men specially trained in the elements of mechanical engineering who only require experience at sea and a course of post-graduate instruction to make them valuable engineers in the navy. I recommend that Congress be asked to provide, under suitable conditions, for the admission of a certain number of such young men as prove on examination to have the proper attainments. They should serve two years on probation as cadet engineers, and then be examined with the candidates from Annapolis for commission as assistant engineers, the examination to be competitive. I cannot see why a young man who fits himself without expense to the government for the naval service should not have the same chance to enter it as a more favored one whose education has been paid for by the government.

The bill does not interfere with the present course at the Naval Academy, but simply asks that, in addition to the number of engineer graduates which that institution supplies, the navy be given the benefit of the supply from the many good engineering schools of the country. With this bill a law, the study of engineering will be encouraged as contemplated by the act approved February 26, 1879, and the country will have, in case of war, a larger number of engineers at its command. The colleges which teach engineering will then bear the same relation to the Naval Academy that the increasing of valuable marine engineering works now bear to our navy-yards. By giving our ship and engine builders a chance for work we have vastly increased our naval resources, and this bill aims to do the same thing for the personnel which is to direct the results of their labors.

If experience proves that the graduates of the technical schools surpass those sent out by the Naval Academy, then there is a radical defect in the method of instruction pursued at Annapolis. Many of the engineer graduates of that institution believe that such is the case, and this bill will show how far their fears are true.

The bill provides that the appointments of cadet engineers shall be made from the graduates of the engineer division of the United States Naval Academy at the end of the four years' course, and from the graduates of those technical schools of the United States whose course of instruction in mechanical engineering may be considered satisfactory by the Secretary of the Navy. All applications for appointments from civil life must be made to the Secretary of the Navy on or before June 15 of each year; candidates must not be less than nineteen nor more than twenty-three years of age, and before appointment shall undergo a physical examination before a board of medical officers of the navy.

The cadet engineers so appointed shall be assigned to cruising ships for one year, and at the end of that year be ordered to the various navy-yards for such practical instruction as may be recommended by the chief of the bureau of steam engineering and approved by the Secretary of the Navy. Two years from the date of their appointment as cadet engineers these officers who pass a physical and competitive examination shall be commissioned the assistant engineers of the navy. Those who pass, but who do not receive commissions, shall be honorably discharged from the naval service and receive one year's pay. The pay is $1200 per annum at sea, $1000 per annum on shore duty and $700 per annum on waiting orders or on leave.

Such a measure would be far-reaching in its effect. By reason of the increase in the number of engineer officers it would furnish to each institution which would comply with it requirements a trained and scientifi mechanical engineer, who would b the peer of those professors now r tained by the heavily-endowed colleges. The directors of the scientifi colleges of Harvard, Ann Arbor an Cornell are men who formerly hel commissions as engineer officers of th navy. Such would be the character o the instructors who would be sent b our engineer-in-chief.

It would provide openings for th graduates, and with such an incentiv as the securing of a commission in th navy, our young technical student would work with renewed zeal an interest.

The competition for the cadetshi would be very keen, for many youn men who intended to follow eventuall an industrial career would seek suc appointments for the valuable instruction of two years of travel and stud aboard a warship.

It is a civil-service bill of the mos practical nature, for the method of selection is almost an ideal one, and ther is no doubt but that the worthy an capable men would be honored unde such a system.

The several colleges would be materially aided by the clause which permits the Secretary of the Navy to loa models and such machines that hav been removed from the war vessel There are engines at the navy-yard which would be invaluable for instruction, but which may reach the scra heap unless otherwise disposed of Experimental propellers, steam indicators, small coil boilers, are amongs the machines which the colleges woul receive.

The primary purpose of such a measure would be to give the naval servic sufficient men to supply the engineering needs. It would also provide naval engineering reserve which woul be available in time of war.

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who had taken advantage of what had been done for them. It is, therefore, a fitting supplement to the other national measures for encouraging education in technical matters.

The Assistant Secretary of Agriculture, who was president of the Agricultural and Mechanical College at Knoxville, Tenn., says of this projected measure: "It is founded upon patriotism and common sense."

The navy is a conservative organization, and no one can secure a commission in the executive or engineering corps unless he is a graduate of the Naval Academy. The practical effect of such a law is that each congressional district can only secure one commission in the navy in those corps every six years. Such a policy is unjust to the nation and to the youth of our land. And this evil will be corrected by the proposed measure.

An important work now awaits some strong statesman of the nation. The representative who will take the measure in hand and make it a law will show that he possesses the attributes of greatness, and can render a service to his people whose value is beyond limit. A great reward awaits him, for his name will be associated with what some think the best technical educational measure that has ever been presented before the Congress of the United States. He will receive practical support from every State in the Union, for even historic Harvard approved the generous features of this work.

There is a special work also for the respective presidents of the several mechanical colleges. They should consult immediately as to the best means of making this bill a law. Commodore Melville, the engineer-in-chief of our navy, will undoubtedly co-operate with them, as his engineering bureau is already crippled for want of commissioned officers.

Detail of Naval Engineers to Scientific Institutions South.

[From MANUFACTURERS' RECORD, October 18, 1895.]

Of all the laws relating to the navy, that which most concerns the industrial South at the present time is the one relating to the detail of naval engineers at the several technological colleges and scientific institutions.

The following is a copy of the law:

For the purpose of promoting a knowledge of steam engineering and iron shipbuilding among the young men of the United States, the President may, upon the application of an established scientific school or college within the United States, detail an officer from the engineer corps of the navy as professor in such school or college; provided, that the number of officers so detailed shall not at any time exceed twenty-five, and such details shall be governed by rules to be prescribed from time to time by the President; and provided further, that such details may be withheld or withdrawn whenever, in the judgment of the President, the interests of the public service shall so require.

It is surprising that the leading scientific institutions of the South have never availed themselves of the benefits that would accrue to them by making requests for such details.

The great technological colleges of the North have been greatly aided by this law, and today the director of the Engineering College at Harvard University, the director of the Mechanical Engineering College at Cornell, the professor of mechanical engineering at Ann Arbor, the head of the department of mechanical science at the University of Pennsylvania, and other men of such character and ability, are men who formerly held commissions in the naval engineering corps.

In addition to the institutions mentioned, the following scientific institutions of learning have had naval engineer officers attached to their faculties: The Massachusetts Agricultural and Mechanical College, Worcester Free Institute, Pratt Institute of Brooklyn, Stevens Institute of Mechanic Arts, at Hoboken; Lafayette College, St. John's College, at Annapolis; Williamson's School of Trades, Pennsylvania State College, Ohio State College, Purdue

University of Indiana, University of Illinois, Chicago Manual Training School, Madison University, University of Colorado, Hamilton, Union and Madison Universities of New York, and at several other schools of learning in the West.

It was undoubtedly the intention of the framers of the law that these men should be sent to localities where there were no well-endowed scientific schools, and where the addition of these trained men to the faculties would encourage and promote the study of the mechanic arts.

There were but few Southern institutions which made application for the detail of such officers. At the request of the respective presidents, naval engineer officers were detailed to the following Southern schools of learning: The Virginia Agricultural College, the University of South Carolina, also to Vanderbilt University and the University of Tennessee.

The men detailed by the respective engineers-in-chief were a picked body of men. These officers entered upon their work with a deep sense of the responsibility that had been thrust upon them, and with an earnest desire to accomplish good. In nearly every case they were graduates at Annapolis, and in addition to having secured a superior scientific education, they had traveled extensively, had personal charge of the intricate machinery on board our warships and had unequaled opportunities with the principles of their profession. Possessing executive ability and thorough knowledge of men, they were able to command the unqualified respect of their students.

Their work was varied, for these men had discretion enough to adapt themselves to existing conditions. Where colleges were heavily endowed and unlimited resources were at their disposal, the character of their work was of a high professional and technical order. It included: Testing of the materials of construction in tension, tortion, compression, etc.; the testing of lubricating oils; standardizing steam gauges, indicators and meters: the analysis of gases of combustion; trials of engines and boilers; setting of valves by model, as well as on the engines; measurements of clearance and engine power. They had students in special work, such as machine design and naval architecture. The general scope of their work included everything relating to the theory of steam and other gases. There are probably no four men in America today who will more greatly influence the study of the mechanic arts and sciences than Professors Hollis, of Cambridge; Thurston, of Cornell; Cooley, of Ann Arbor, and Spangler, of the University of Pennsylvania. These men are not now connected with the naval service, but each one of them held a naval engineer's commission previous to accepting the important work in which he is now engaged.

The heavily-endowed schools of the North had a full realization of the import of this law to the development of engineering sciences. They not only secured the detail of such men, but they never permitted them to return to the service.

Those institutions of the North which did not possess such financial revenues as Cornell University also secured strong men from the navy. The officers so detailed realized that their course of instruction had to be of a more practical nature, and they cheerfully carried on a system of instruction which was in accordance with the resources of the schools to which they were attached. At these schools the work of the engineer officers was something of the following character: A series of lectures on mechanical drawing and elementary steam engineering; a course of lectures in thermo-dynamics; instruction in machine design and elements of mechanism; aid in the preparation of theses; the conduct of engineering tests; the laws of steam. and a general study of the theory of the steam engine. Telling in detail of the work done by these men would include a summary of mechanical engineering science.

There was a third class of schools to

which these men were sent. At such institutions there were practically no funds available for carrying on efficient work, but the presidents of such institutions appreciated the worth of the men who had been so detailed, and urged them to commence their undertaking with the limited facilities and funds on hand. There the work of the naval engineer officer was of a more practical nature. In some cases, with the aid of a few zealous students, he fitted the line shafting, installed the engines and secured the few power tools. His bright uniform was discarded for a dungaree suit, and often he gave personal instruction in the pattern and forge shops. Innumerable letters were written to the manufacturers of steam machinery in the North, and the officer's plant was gradually increased through the donations of liberal and patriotic men. This earnest work commanded the admiration of trustees and regents, and it was not long before special funds were given these men to extend their work. With grateful remembrance these officers recalled to mind the unflinching support they received from the presidents of the respective institutions. It was a labor of love on the part of these men. If they did not possess great laboratories with inexhaustible supplies for original research, they gave to their individual students something far better, which was the inspiration and personal instruction of men who not only had a deep sympathy for those who were under their charge, but an abiding faith in the ultimate success of their work.

It would be impossible to tell of the work done by these men, but the schools of the South can get a fair knowledge of the readiness of resource of these officers from what was done in the city of Baltimore. This city claims the honor of being the first city in which a school entirely devoted to manual training has been organized as a part of the public-school system. The school has developed rapidly, and has grown not only in numbers, equipment and efficiency, but also in public favor. The highest object of the shop work is not construction, but instruction, and its highest worth is its educational value. It does not teach trades, but lays the foundation for many trades. The school opened in March, 1884, and Chief Engineer John B. Ford, United States Navy, was detached from the bureau of steam engineering and ordered as its director at that time. Under his guidance the school began to grow as if by magic. Since the school opened an immense amount of work has been done. There is a carpenter shop which is fitted with double benches. There is a pattern shop fitted with necessary machine tools; a machine shop which contains all the requisites of a well-appointed plant; a forge in which heavy welds can be made. There is a foundry where troughs are arranged for molding in green sand and loam.

Chief Engineer Ford, though firm in discipline, yet had the happy faculty of gaining the love and esteem of his students, and the boys in his shop felt that they always had a personal friend. Several of the leading technological universities of the country sought the services of this man, and the fact that he commenced his work in such a modest manner shows the real worth of the man. His engineering knowledge, powers of application and marked ability in his profession would have made him grace the chair of any school of learning in the country. The services of this man are particularly spoken of in order to impress the trustees and regents of our Southern scientific institutions with the fact that each individual State, by reason of the difference of conditions, will require a special man for each university, and we believe that the men who could greatly adapt themselves for the work at the respective State institutions would be men who had traveled in every part of the world and had come in contact with all manner of individuals.

In every case where these men were

detailed for duty they impressed the fact upon the several presidents that in no manner should they be regarded as rivals to anyone connected with the several colleges. They recognized the fact that they had been sent to the colleges to supplement the work of others, and not to supplant or destroy anyone. Their pay was given them by the national government, and as they knew that they would be provided for in old age, they did not concern themselves much about pecuniary compensation. They did insist, however, that the several colleges should contribute something to their support, for experience had taught them that the man who put no value upon his own services could not have it regarded as of much value by others.

It is beyond question, other things being equal, that those who have had experience at sea in manipulating and caring for intricate machinery, who have in many cases designed these machines, who have had opportunities for watching the progress of mechanical science, and who have been fortunate enough to commence their career with a highly-trained scientific education, should have many requisites for developing into proficient professors. When these men are called to teach mechanical drawing and engineering science they should have scientific mental equipment above the average man. It should follow, then, that naval engineers who have any aptitude and capacity for imparting instruction should make ideal instructors in constructive and experimental designs. There is an instruction that is not found in books, and these men impressed this fact upon their students.

It is now within the province of the fifteen or twenty engineering schools in the South to secure the detail of one of these men to each of these institutions. Secretary Herbert must know of the needs of the South in regard to the establishment of such scientific institutions. At the present time it may be impossible for him to fill these details, but if the several institutions will urge upon the members elect of the Fifty-fourth Congress the necessity of giving the engineer-in-chief sufficient officers to discharge the duties required, the Secretary of the Navy will be in condition to detail men to such colleges that are desirous of securing naval engineers for professors of the mechanical sciences.

Dr. McBryde, the efficient and able president of the Agricultural College at Blacksburg, Va., as well as Dr. Hopkins, the president of the Georgia School of Technology, have been appointed judges at the Atlanta Exposition. They can render the South a great service by calling the attention of the committee on technical education to the importance of this subject. A careful investigation should be made concerning the possibility of securing an officer for every scientific institution in the South.

The naval engineer officers who were detailed to the universities at Knoxville, Tenn., and Columbia, S. C., are within easy reach, and as they took particular interest in the development of technical education in the South, they would undoubtedly give valuable suggestions in regard to this matter. A simple request to the Secretary of the Navy would have them sent to report to the president of the exposition to give testimony upon the subject.

It is safe to say that the services of men of equal ability could not be secured at a less sum than $4000. With twenty men detailed for this work in the South, this would represent a great worth of talent given to the cause of technical education.

With the numerous calls made upon the revenues of the several States, it will be impossible for the cause of technical science to receive from State legislation such an impetus as is needed. This national aid is within easy reach, and it is for our people to say if they desire to avail themselves of it. The South's greatest need, looked at from some points of view, is technical educational facilities. It must move promptly in this direction.

IMPROVEMENT OF THE NAVY

BY

Reorganization of Corps of Naval Engineers.

REMARKS

OF

HON. WATSON C. SQUIRE,

OF WASHINGTON,

IN THE SENATE OF THE UNITED STATES,

Tuesday, December 10, 1895.

The Senate having under consideration the bill (S. 735) to reorganize and increase the efficiency of the personnel of the Navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval engineering reserve for time of war; to establish a naval engineering experimental station, and to encourage the study of the mechanic arts, and sciences, and particularly that of naval engineering in the technological colleges of the country.

Mr. SQUIRE said:

Mr. PRESIDENT: I desire to say a few words in reference to the bill by way of explanation. It provides first for an increase in the number of the Corps of Naval Engineers. On this point we have the report of the Committee on Naval Affairs, submitted April 20, 1892, in which they call attention to the fact that the Corps of Naval Engineers then consisted of 189 persons in all, and in the opinion of the committee at that time there were required 303 officers for the Bureau of Engineering. The committee in their report state as follows:

> It will be seen that the total number for supplying effectively the demands of the Navy for sea and shore duty is 303, an increase of 114 over the present list, as stated above.
>
> In view of the increase in the number of war ships, completed and provided for with modern, complicated machinery, propelled almost entirely by steam power, your committee is of opinion that this number added to the Engineer Corps of the Navy is not only not excessive, but necessary to meet the requirements of the service.

In the same report I notice a paragraph from the report of the Chief of the Bureau of Steam Engineering, as follows:

> There is still another and very important point that is generally overlooked when considering the Engineer Corps of the Navy, and that is that it is a part of the military organization and second to none in importance. *In the naval battle of the future the engineer staff will have a difficult and important part to perform, and if there is failure in the engine room no amount of skill and bravery on the bridge may suffice to avert disaster. Celerity of movement has decided many a naval battle and will decide many more, and the celerity of movement of a modern ship depends directly on the skill of her engineer officers.*

There are three or four other points to which I wish to refer briefly. The bill proposes to give positive rank and title to the officers of the Corps of Engineers, or the Bureau of Engineering, as it is termed in the bill. The third point is that the command of the engineer force shall be under the authority of the commanding officer of the ship. Fourth, the manner of selecting cadets and filling vacancies in the Engineer Corps should be changed. This is the educational feature of the bill. Fifth, the enlargement of the duties of the Engineer Corps of the Navy in accordance with modern requirements is provided for in the bill.

Mr. President, by the courtesy of Rear Admiral Beardslee, commanding the United States naval forces on the Pacific coast, I recently visited the flagship *Philadelphia*, and had great satisfaction in examining that splendid cruiser. Going through the vessel below the water line, I observed the vast amount of machinery, the complicated elements that enter into its construction, making the care of a modern vessel of war very important as regards the feature of steam engineering. One passes through compartment after compartment, and is almost lost in bewilderment in the mazes of the complicated machinery around him. It occurred to me that not enough attention has been paid to the personnel of the Navy as respects steam engineering. Truly the propelling power is the soul of the ship. Without it the ship can not be handled and is totally useless. This power is under the supervision of the engineer officers. Therefore it is needful to have a high order of personnel, a larger number of officers, and those of great attainments and proficiency.

If I am correctly informed, steam power as applied to the propulsion of ships of the Navy has originated so recently as since the year 1815. At first it was so little used that the smokestack was telescoped up in sections for occasional use. This fact will indicate its then comparative unimportance. Since those days steam power has gradually gained in importance until it has become the sole propelling power, and sails are now entirely discarded in the "new Navy." This fact was distinctly recognized in the British navy when Capt. (now Rear-Admiral, retired) P. H. Colomb, royal navy, said:

> What we have to do in the navy is really to welcome the coming, speed the parting guest. The parting guest is the seamanship of the past, that which confined itself to the management of the ship under sail alone. The coming guest is steam, mechanism, and forces of all kinds other than the winds. Now, instead of frankly going out, shaking hands, and bidding good-bye to the parting guest, and wishing him well, and going down to the steps to meet the new one and bring him in, we are holding on to the coat tails of the old one, and trying to shake hands with the coming guest with the left hand, or perhaps with only one finger.

In 1891, Assistant Secretary Soley, of the Navy, said to the graduating class at the United States Naval Academy:

> To-day the steel ship, carrying thirty or forty separate engines, cut up into innumerable compartments, lighted by electricity and as fine and complicated in its interior details as the works of a watch, requires for its management a far more advanced training.

What was true a few years ago is still more impressive to-day, when we have one great battle ship in commission, another nearly completed, other battle ships in process of construction, besides several torpedo boats of the highest type now contracted for, and twelve others of the latter class included in the estimates of the Department for the next fiscal year.

In order to provide additional engineer officers, many years ago—I think it was in the year 1879—there was a provision of law enacted authorizing the President to appoint 25 of the officers of this bureau to give instruction in engineering and marine architecture in the

[illegible]

colleges and schools of the land. The State University of Washington has recently made application for such an officer, and I learn that the request has been up to the present time refused or not acted upon, on the ground that there are not enough officers to enable a sufficient number to be detailed for such duty, and that there is actually only one such officer now so employed in the United States. There is no doubt of the fact that the great engineering schools of our principal universities, such as Yale, Harvard, Cornell, and many others that I might mention, have been increased in usefulness by reason of the detail of officers of the Engineer Corps of the Navy.

We are building in this country vessels that were unknown to former times, and we need adepts in the art of engineering and marine architecture. There is no way to obtain a suitable class of men except by preparing them in the various educational schools. Ships can be built, but men can not be built. When war comes, if it should come, unhappily, we will need proper men to handle these great engines of war. The only way to have such men is to educate them in advance. I believe the provisions of the law of 1879 should be carried out, and that the schools and colleges of the land which apply for professors of steam engineering and naval architecture should be accommodated by the detail of officers for such purpose. But that is only one of the features which contribute to the practical merit of this measure.

It is evident, too, that there is great danger of the breaking down of those officers. They are employed in very difficult work. To take care of all this valuable property requires a high degree of skill, and causes an immense strain upon the officers. It is well known that our battle ships cost about $4,000,000 apiece, and they are liable to have something out of order all the time. In fact, one of the officers of this corps told me that there is usually something out of order on a war vessel all the time requiring the attention of an expert. Oftentimes those officers have to submit to very severe physical strains. They have to go down and work in the hold of the ship, where the temperature ranges from 150° to 170° Fahrenheit, and this causes great physical exhaustion. I believe that the number of engineer officers should be increased so as to make provision for these breakdowns, and to enable a sufficient number of officers to be employed on vessels to allow for necessary changes in the supervisory watch.

I am not undertaking to present this matter in full to-day. I wish merely to say enough to call the attention of the Senate to the subject. I believe that this branch of the service of the Navy should be encouraged and dignified and rendered more attractive and popular to the cadets and those naturally fitted to become engineers, and for this and other reasons that the officers should be given positive rank and title, so that a mere officer of the deck, perhaps an ensign, can not control a commodore in the Bureau of Engineering unless such officer shall be in command of the ship. I think, too, that the manner of selecting cadets and filling vacancies in the Engineer Corps should be changed so that Senators shall have the appointment of such cadets. Something must be done or the personnel of the engineering force in the Navy will fall far below the proper standard. In fact, it may be considered relatively below it to-day, as shown by the report of the Naval Committee in 1892. We have in commission in the Navy at this time 42 vessels, with 19 more vessels building, making in all 61. It is useless to undertake to manage this vast interest without having competent men, men thoroughly educated and prepared, and a sufficient number of them to provide for the necessary changes. This branch of the service, as I have stated, should be popularized in every suitable way.

Then, again, I believe that some of the duties of the officers of this Department should be changed. For example, I think that the purchases of coal to be tested for use on our war vessels should be made through the Bureau of Engineering and not through the Bureau of Equipment and Recruiting. The engineers know, or can ascertain, what should be tried in the way of coal, and what kinds of coal are best adapted to the service. On the Pacific Coast we have had occasion to criticise severely the fact that our American vessels of war have not been using the coal of the United States, but have been going to British Columbia for their coal, very much to the disgust of our own American people on that coast. We believe that suitable appliances should be prepared for using American coal. If there is any trouble on account of what is called the forced draft or the too free burning of the coal, then appliances should be arranged and regulated to use American coal, so that when vessels find themselves engaged at some time possibly in the future with a foreign foe they can obtain their coals in the United States, and those coals will be suitable to use in their furnaces. Why should we wait the advent of war before we adapt our war ships to the supplies obtainable in time of war? Therefore I think this question is one of vital importance. I want to see not only the question of experimental tests but the whole question of coal purchases referred to the Bureau of Engineering. If necessary, this Bureau can adapt their furnaces and appliances to suit the coal to be obtained on any part of our extensive coasts. But I have no doubt that much depends upon proper tact and management in the use of coals in the fast-burning furnaces. The whole responsibility for this should be thrown upon the Bureau of Engineers, where it properly belongs.

How ridiculous for our Navy to depend upon foreign coal when there are vast supplies of American coal within easy reach, suitable for steam purposes, as proved by long use and experience!

Then, too, Mr. President, we have all the electrical appliances to be cared for. The officers of the Bureau of Steam Engineering now have the work of caring for those appliances, putting them in repair; and I believe the whole subject of electrical apparatus should come under the Bureau of Engineering, reorganized as proposed in this bill. In fact, the subject is one that should engage the very early attention of the Senate.

I move that the bill be referred to the Committee on Naval Affairs, and trust we may receive a favorable and prompt report.

The motion was agreed to.

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IN THE HOUSE OF REPRESENTATIVES.

JANUARY 10, 1896.

Mr. Francis Henry WILSON, of New York, introduced the following bill; which was read twice, referr the Committee on Naval Affairs, and ordered to be printed.

A BILL

To organize and increase the efficiency of the personnel of Navy; to increase the usefulness and numbers of the Co of Naval Engineers; to induce the scientific institution provide a naval-engineering reserve for time of war; establish a naval-engineering experimental station, and encourage the study of the mechanic arts and sciences, particularly that of naval engineering in the technologi colleges of the country.

Be it enacted by the Senate and House of Represe tives of the United States of America in Congress assemb That the active list of the Engineer Corps of the Navy sh consist of eighteen captains, twenty-five commanders, si lieutenant-commanders, seventy lieutenants, sixty-five li tenants of the junior grade, and sixty-five ensigns, an number of engineer cadets, as provided by subseq sections.

That these offices shall be filled by the commissioning of the officers of the Engineer Corps of the Navy borne on the active list at the time this bill shall become a law, in the order of seniority, beginning at the top.

That there shall be a chief of the bureau of engineering of the Navy Department, who shall be director-genera of naval engineering, and while holding said office shall have the rank of rear-admiral.

That there shall be two inspectors-general of naval engineering, who while holding said office shall have the rank of commodore.

SEC. 2. That the director-general of naval engineering and two inspectors-general of naval engineering shall be appointed by the President, by and with the advice and consent of the Senate, from the list of the officers of the Engineer Corps of the Navy not below the grade of lieutenant-commander, and shall hold office for the term of four years.

SEC. 3. That the duties of the director-general of naval engineering shall comprise everything relating to the engineering material and personnel, and that he shall be a member of every naval board concerning the policy of the Navy.

SEC. 4. That the senior inspector-general of naval engineering shall be detailed as assistant to the chief of the bureau of engineering of the Navy Department, and in case of the [illegible] sickness of the chief of [illegible] directed by

the President according to the provisions of section
hundred and seventy-nine of the Revised Statutes, perf
the duties of such chief of bureau until his success
appointed or such absence or sickness shall cease.

That the duties of the senior inspector-general of n
engineering shall, under the direction of the chief of bu
of engineering, consist of designing and preparing the p
and specifications of all new machinery. He shall also l
direct charge of all experimental research in connection
matters relating to the marine, electrical, and mechar
engineering sciences under the cognizance of the burea
engineering. At least once every two years he shall
those technological schools which shall have establish
course of engineering satisfactory to the Secretary of
Navy, and where an officer of the Engineer Corps of
Navy is detailed; he shall make such reports as will s
their usefulness and efficiency to the Naval service. He s
be a member of the speed-trial boards, which shall rec
mend whether vessels built by private firms shall be acce
by the Government. He shall prepare such forms and bo
of instruction as will aid the officers of the Engineer C
in the more efficient performance of their duties. He s
also perform such duties as may be assigned him by
directo neral of naval engineering.

S . 5. That the junior inspector-general of naval e
neerin l be detailed as assistant to the chief of burea

of naval engineering shall be, under the direction of the chief of bureau of engineering, as follows: He shall have the general supervision of all construction and repairs under cognizance of the bureau of engineering. He shall have charge of the selection of the various auxiliary mechanical appliances required for naval purposes which are not designed by the bureau of engineering, and shall make such experiments from time to time as will secure for the naval service the highest types of such machines for installation aboard our warships. He shall make periodic visits to the several industrial plants where such machines for naval purposes can be built, and shall also visit modern merchant vessels. He shall submit detailed reports to the director-general of naval engineering in regard to the efficiency of the various types of such machinery and as to the best manner of their installation. Under his direction there shall be prepared monographs upon subjects relating to the naval engineering profession, which shall be furnished free of cost to all students who are pursuing a course of engineering which shall fit them for appointment as engineer cadets.

SEC. 6. That every officer of the Engineer Corps shall be required, before promotion to the next higher grade, to pass the examination now provided for by section fourteen hundred and ninety-three of the Revised Statutes. All except those who served in the civil war shall also be required, before promotion to the next higher grade, to pass

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dred and ninety-six of the Revised Statutes, as amended the following section

Sec. 7. That section fourteen hundred and ninety Revised Statutes, be, and is hereby, amended by the a tion of the following proviso:

"*Provided*, That the aforesaid board shall be comp of officers of the same corps as that of the officer to examined, and that no records than those which may b file in the Navy Department from commanders in ch commanding officers, and senior officers of the same c as that of the officer being examined shall be accepted evidence in determining his mental and professional qu fications."

Sec. 8. That the title "Bureau of Steam Enginee of the Navy Department" is hereby changed to "Burea Engineering of the Department of the Navy," and it s have charge of all that relates to the designing, buildi installation, fitting out, repairing, and management of main and auxiliary steam, hydraulic, pneumatic, elec and other machinery and their appurtenances used on bo of naval vessels, not including gun carriages, torped torpedo tubes and fittings.

That the bureau of engineering shall hereafter h control of all matters relating to the inspection and tests steel material used in the construction of vessels of war, a of all matters relating to the purchase, inspection, charac and quality of coal, and of all other kinds of fuel to b for all naval purposes; and that all tests of such fuel shall be made under the direction of the bureau of engineering.

SEC. 9. That all boards for the examination, inspection or survey of machinery, engineering material, tools and supplies, or contract therefor, under the cognizance of the bureau of engineering, shall, when practicable, be composed exclusively of officers of the Engineer Corps.

SEC. 10. That the senior engineer officer attached to a vessel of the Navy in commission shall command the engineers' division and shall be directly responsible to the commanding officer for the preservation and efficient working of all machinery and appliances under the cognizance of the bureau of engineering; for the discipline, instruction and training of the enlisted men of the engineers' division; and, in general, for the execution of all details of duty in connection with the engineering department of the vessel. He shall have no authority independent of the commanding officer, and in the performance of his duty shall be regarded as executing the orders of the commanding officer. The officer on duty in the engineering department shall be regarded as the representative of the commanding officer so far as the duties of the department are concerned, but he shall at all times be subject to the orders of the senior engineer.

SEC. 11. That officers of the Engineer Corps of the Navy shall, after January first, eighteen hundred and ninety-seven, be placed on the retired list, when they arrive at the age of sixty years, and officers so retired shall receive seventy-five per centum of the sea pay to which they are entitled at the date of such retirement as established by existing law.

Any officer of the Navy who has served or shall have served faithfully thirty years may, upon his own application and in the discretion of the President, be retired from active service and placed upon the retired list with three-quarters of the sea pay of his grade, and any officer below the rank of commodore who has served or shall have served honorably thirty-five years may, upon his own application and in the discretion of the President, be retired from active service and placed upon the retired list of the Navy with the rank and retired pay of the next higher grade.

SEC. 12. That each Senator of the United States and each Delegate of the House of Representatives shall nominate candidates for appointment as engineer cadets at the United States Naval Academy in the same manner and under the same regulations as now govern the nomination and appointment of naval cadets by Members and Delegates of the House of Representatives.

That the President shall appoint one engineer cadet from the District of Columbia and three at large, as he now appoints naval cadets.

Until the number of officers of the Engineer Corps provided for in this Act is reached each Senator shall be at one and the same time, but after that number has been reached but one cadet at one and the same time.

After the passage of this Act, at the date designated, the senior Senator from each State shall nominate a candidate for appointment as engineer at the United States Naval Academy. At the same time in the following year the junior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy, and any vacancy in the preceding year's appointments shall be filled by the Senator who made the original nomination, or by his successor. The third year the senior Senators shall make their second nominations, and the fourth year the junior Senators shall make their second nominations, and thereafter whenever a vacancy occurs until the number of officers in the Engineer Corps has reached the limit fixed in this Act, when each Senator will be entitled to but one cadet pursuing the course at any one time.

The Presidential appointments, one from the District of Columbia and three at large, four in all, and the nominations by the delegates shall be made one each year, in each case until the positions are filled, and thereafter whenever a vacancy occurs. The Secretary of the Navy shall designate the order in which the delegates from the Territories shall nominate their candidates. A vacancy in the above Presidential and delegate appointments occurring yearly appointments next following, in addition to the o inal appointments of that year.

From the passage of this Act until the class f appointed under its provisions shall enter its fourth y appointments shall be made to the engineer division of first class of naval cadets at the United States Na Academy according to the laws in force governing s appointments previous to the passage of this Act, exc that volunteers only shall be so appointed.

SEC. 13. That graduates of technological schools of United States whose course of instruction in mechan engineering may be considered satisfactory by the direc general of naval engineering, and approved by the Secret of the Navy, may be eligible for appointment as engir cadets in the Engineer Corps of the Navy.

That the appointment of engineer cadets in the E neer Corps of the Navy shall be made from the engir cadets of the United States Naval Academy at the en the four years' course, and from the graduates of the bef mentioned technological schools.

That on the thirteenth day of June after the pas of this Act, and yearly on the same date and until number of commissioned officers allowed by this Act been r hed the number of engineer cadets appointe the E neer Corps of the Navy shall be thirty plus numbe s occurring in the Engineer Corps number of commissioned officers herein provided for has been reached the number of appointments made on the thirtieth of June of each year shall be double the number of vacancies occurring in the lowest grade of commissioned officers in the Engineer Corps of the Navy during the year then ending.

Until the total number of officers in the Corps provided for by this Act is reached, the number of graduates of technological schools appointed engineer cadets, as above provided, is to be equal to forty, less the number appointed from the United States Naval Academy, and after this limit is reached to be equal to the excess of the existing vacancies over the number of engineer cadets of the engineer cadets of the United States Naval Academy available each year.

All applications for appointments from civil life must be made to the Secretary of the Navy on or before the first day of June of each year. Such candidates must not be less than nineteen nor more than twenty-four years of age, and before appointment must undergo a physical examination before a board of medical officers of the Navy, and must possess the physical qualifications required of naval cadets.

SEC. 14. That the engineer cadets appointed in the Engineer Corps of the Navy shall be assigned to cruising ships for one year, and at the end of that year shall be
r one year to the various working navy-yards or
tific post graduate schools as may be stablished

as may be recommended by the director-general of na engineering and approved by the Secretary of the Navy. the conclusion of this two years' service they shall unde a physical examination before a board of medical officers the Navy and a professional examination at the Uni States Naval Academy as now prescribed by regulation, a from those who pass, and in the order of merit as shown that examination, shall be commissioned as engineer offic to fill vacancies in the lowest grade of commissioned offic of the Engineer Corps of the Navy: *Provided*, That at le one-half of such vacancies shall be filled by graduates of United States Naval Academy: *And provided further*, Th after the number of commissioned officers allowed by t Act has been reached, the number of officers so commission in the lowest grade of the Engineer Corps shall be equal the number of vacancies occurring in the Engineer Corps the Navy. Those engineer cadets who have successfu passed the examination but who do not receive co missions shall be honorably discharged from the na service and shall receive one year's pay, as now provided law. If the number of vacancies in any year is greater th the number of engineer cadets who have successfully pass the required examination, the surplus vacancies shall filled from the successful engineer cadets of the followi years, as they become available.

Any enlisted man who has served three years in t twenty-five years of age, shall have an opportunity to compete with the engineer cadets for commission in the Engineer Corps of the Navy. He shall be commissioned as assistant engineer, if his order of merit at such examination shall entitle him to such commission.

The pay of engineer cadets shall be the same as that now provided by law for naval cadets, except that they shall receive the rate of pay known as "sea-pay" during the time they are under instruction at the navy-yards and scientific post-graduate schools as above provided for.

That upon application to, and approved by, the Secretary of the Navy, an officer of the Engineer Corps shall be detailed to each technological school or college mentioned above, as professor of naval engineering, and that the number of officers now authorized by law for such purposes is hereby increased to permit such detail.

SEC. 15. That in order to promote the study of marine engineering as contemplated in the previous sections, the bureau of engineering is hereby empowered to loan, under conditions imposed by the Secretary of the Navy, to such scientific institutions as may establish the course of study herein provided for, and shall give the Navy a corps of trained men as a naval engineering reserve, such models, plans and machinery as can be spared without detriment to the naval service.

SEC. 16. That sections fourteen hundred and eighty-

Statutes of the United States be amended so as to read follows:

"SEC. 1484. Officers of the staff corps of the Na graduated at the Naval Academy shall take precedence their several corps and in their several grades, and sh take rank with officers of the line of the Navy, accordi to the dates borne by the diplomas or certificates awarc to them at the completion of the course of study at t Naval Academy before performing service afloat in otl than practice ships, and according to their relative p ficiency at such dates, as shown by the ratio which t merit mark obtained by each graduate bears to the ma mum obtainable mark, and officers who have been lawfu advanced or lost numbers on the Navy Register shall considered to have gained or lost rank accordingly."

SEC. 17. That officers of the Corps of Naval Engine shall not be entitled by virtue of their rank to command the line or in other staff corps, except when assigned such command or duty by competent authority.

SEC. 18. That every commissioned officer of the En neer Corps of the Navy who shall have a regular or sup visory watch in the engine room shall be a ward-room offic

SEC. 19. That the sum of seven hundred and fifty c lars is [illegible] appropriated to engrave a plate for printi the nev [illegible] ons, which shall be furnished the offic the [illegible] affected by this Act.

neers all the naval cadets of the engineer division who have completed the course of study at the Naval Academy, and who are now performing duty at sea or elsewhere, shall be ordered to Annapolis at the earliest practicable day for the final examinations preliminary to promotion, and upon passing the several examinations satisfactorily, as required by the Academic Board, shall be commissioned by the President as ensigns of the corps.

SEC. 21. That for the purpose of providing a suitable place where engineering experiments may be carried on to the best advantage the naval station at New London, Connecticut, shall be placed in the charge of the chief of the bureau of engineering in the Department of the Navy, who shall, under the Secretary of the Navy, conduct such experiments and make such researches as may be necessary or expedient for the best interest of the naval service. That there shall also be established at this station, which shall be called the United States naval experiment station, a post-graduate course for engineer officers of the Navy and Revenue-Marine Service, under such rules as may be approved by the Secretary of the Navy.

That the sum of five thousand dollars, or so much
of as may be necessary, is hereby appropriated, in
the regular appropriation now made for the
New London, C
carry into
of this section.

Corps of the Navy shall be the same as that for the li grade for grade: *Provided*, That the pay of a commodo on shore duty shall be four thousand five hundred dolla on leave or waiting orders, three thousand six hundred d lars; that the pay of a captain on shore duty shall be fo thousand dollars; on leave or waiting orders, three tho sand three hundred dollars; that the pay of a command shall be, at sea, four thousand dollars; on shore duty, thr thousand five hundred dollars; on leave or waiting orde three thousand dollars, and that the pay of no officer w served in the civil war shall be reduced by this Act.

SEC. 23. That all laws or parts thereof now in for inconsistent with the provisions of this Act are here repealed.

A BILL

To organize and increase the efficiency of the personnel of the Navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval engineering reserve for time of war; to establish a naval engineering experimental station; and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering in the technological colleges of the country.

By Mr. WILSON, of New York.

JANUARY 10, 1896.—Read twice, referred to the Committee on Naval Affairs, and ordered to be printed.

WASHINGTON, D. C., *February 15, 1896.*

It is believed that some colleges and other institutions of education have supported the Bills pending before Congress, H. R. No. 3618 and S. No. 735, under a complete misapprehension of the results which would follow the enactment into law of those measures.

Your attention is invited to the accompanying argument in relation to these projects of law.

No measure for the benefit of education at large should be joined to one designed to advance the fortunes of individuals or of any body of men; and much less should it be used to urge through Congress a law affecting the fundamental organization of the Navy.

The undersigned respectfully urge a reconsideration of any support of the mixed Bills referred to above, which are drawn neither in the interests of colleges nor to secure increased efficiency in the Navy; and in this request we represent the views of more than seven hundred and fifteen officers, or more than fifty-eight *per centum* of the whole number of commissioned officers of the active list of the Navy.

Very respectfully,

E. O. MATTHEWS, Commodore, U. S. Navy;
GEO. C. REMEY, Captain, U. S. Navy;
P. H. COOPER, Captain, U. S. Navy;
P. F. HARRINGTON, Captain, U. S. Navy;
C. D. SIGSBEE, Commander, U. S. Navy;
B. P. LAMBERTON, Commander, U. S. Navy;
ASA WALKER, Commander, U. S. Navy;
B. F. TILLEY, Lieut. Commander, U. S. Navy;
E. H. C. LEUTZE, Lieut. Commander, U. S. Navy;
ANDREW DUNLAP, Lieut. Commander, U. S. Navy;
D. H. MAHAN, Lieutenant, U. S. Navy;
ALEX. McCRACKIN, Lieutenant, U. S. Navy;
W. KILBURN, Lieutenant, U. S. Navy;
Committee of the Naval Association.

"*From the Engineer Officer's point of view, it is probable that this Bill would be unobjectionable, but it is doubtful whether the change would in the end benefit either the class or the Navy at large.*"—THE STEAM NAVY OF ENGLAND.

ARGUMENT

OF THE

NAVAL ASSOCIATION,

IN RELATION TO THE BILL H. R. NO. 2618 (SENATE
NO. 735).

Washington D. C.:
Byron S. Adams Printer,
1878.

"*From the Engineer Officer's point of view, it is probable that this Bill would be unobjectionable, but it is doubtful whether the change would in the end benefit either the class or the Navy at large.*"—The Steam Navy of England.

ARGUMENT

OF THE

NAVAL ASSOCIATION,

In Relation to the Bill H. R. No. 3618 (Senate No. 735).

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The Naval Association presents the following reasons against the enactment into law of the Bill H. R. No. 3618 (Senate No. 735):

1. This measure is designed to increase the importance of the Engineer Corps of the Navy, and to effect that object the scheme provides as follows:

(*a*) The abolition of the titles of the Engineer Corps, and substitution of the titles of the Line Corps.

(*b*) An increase in the number of commissioned Engineers allowed by law from 195 to 303.

(*c*) An extensive change in the administration of the Navy Department and in the distribution of duties among the Bureaus of the Department.

(*d*) An extensive transfer to the Engineer Corps of duties now performed by officers of other branches of the Navy.

(*e*) A vital change in the system of organization and discipline of war vessels.

(*f*) A large increase in the number of Naval Cadets at the Naval Academy.

(*g*) The establishment in technological schools and colleges of a course of naval engineering, and the assignment of Engineer Officers to such schools and colleges to serve as professors.

(*h*) The establishment of a naval experiment station, under the control of Engineers.

(*i*) Minor provisions, changes in pursuance of the same general object.

NOTE.—H. R. Bill 3618 differs from Senate Bill 735 in Sections 8, 10, 11, 14, 16, and 22. These differences are in important details, but the general scheme is the same in both bills. H. R. Bill 3618 is printed as an Appendix to this argument, and the above-mentioned differences are shown.

2. Increase in number of Engineers and cost thereof.

Section 1 provides for 108 more commissioned Engineer officers than now allowed by law. The increase of pay for the active list of the Engineer Corps, under Section 1, over the pay of the present Corps, would be, in accordance with Section 22 of H. R. No. 3618, approximately two hundred and forty-five thousand dollars ($245,000) per annum.

3. Is an increase in number of Engineers necessary ?

Does the Navy need 108 more Engineers? The Navy Register for January 1, 1896, shows that there are on board of vessels now in commission which would be in commission in time of war—that is, on sea duty—

26 of the 70 Chief Engineers, or 37 per cent.
32 " " 66 Passed Assistant Engineers, or 48 per cent.
26 " " 37 Assistant Engineers, or 70 per cent.

84 " " 173 Engineers of all grades, or 49 per cent.

The Engineer officers attached to the "Wabash," "Vermont," "Richmond," "Franklin," "Lancaster," "Essex," "Alliance," "Enterprise," "Marion," "Adams," "Alert," "Yantic," "Monocacy," "Thetis," "Pinta," "Fern" and "Albatross" are available for sea duty in time of war, as those vessels would not then be in commission or require Engineer officers. We have, therefore, 44 Chief Engineers, 34 Passed Assistant Engineers, and 11 Assistant Engineers on shore duty or on board the vessels named above, as a reserve for time of war, when their places on shore would be filled by Engineers from the retired list. There are, besides, 25 Naval Cadets of the Engineer Division, who have graduated from the Naval Academy and are now on sea service, and who are considered, by Section 20 of the Bill, suitable for commissioned Engineers. The aggregate is 114 now in reserve.

Taking all the vessels built and authorized by Congress, suitable for war service, but not now in commission, and assigning to them Engineer officers, would require 105. The number of Engineer officers assigned to our war vessels is the same as in the British Navy and more than in other great foreign navies.

During the three years following June 30, 1896, there will be graduated from the Naval Academy four classes of Naval Cadets for Engineer duties, containing about 12 in each class.

Any desired number of Assistant Engineers will be available in time of war from merchant steamers put out of service. The Coast Survey, the Lighthouse Service and the Revenue Marine could supply competent Engineers for war service.

It must be remembered also that the Navy possesses a large body of Machinists who now, under the supervision of the Engineers, run the engines and boilers of all our war vessels.

The total number of Engineers required for the Navy on a war basis is within the number (195) now allowed by law. H. R. Bill No. 5215 (S. No. 1797) proposes to increase the number to 225, which would create an ample reserve of these officers.

4. **Proportion of Engineers to number of war ships.**

As less than 50 per cent. of the commissioned Engineer officers of the Navy are now employed in seagoing war vessels, it is not only necessary to inquire why more than a hundred more are asked for, but also what are their appropriate duties on board ship. It need hardly be pointed out that their first duty is to take care of and work the engines and boilers of war vessels.

The principal navies have the numbers of Engineers shown in the following table :

Country.	Number of Ships.	Number of Engineer officers.	Proportion of Engineer officers to each Ship.
France	237	220	0.93
Germany	77	74	0.96
Austria	48	81	1.69
Russia	131	235	1.79
England	333	716	2.15
Italy	99	204	2.16
United States (present law)	75	195	2.60
United States (proposed by Bill)	75	303	4.00

The proprosed increase of commissioned Engineers in our Navy is in direct contrast to the practice of foreign navies, which have gradually decreased the proportion of commissioned Engineers and increased the number of engine-room artificers, or machinists, who attend to the practical running of the machinery, under the general supervision of the educated commissioned Engineers. In the British Navy, notwithstanding the great increase in the number of steam vessels, the number of commissioned Engineers has decreased from 1,418 in 1863 to 716 at present, while the engine-room artificers have increased in number from 90 in 1868, when they were first allowed, to more than 1,500. The other great naval powers are opposed to having any commissioned Engineer officers on board ship, and the junior ones are promoted from the warrant officers of the Engineer branch, a system which works in the direction of great practical efficiency in the subordinate stations of that branch. So we find that, excepting in the British Navy, there are few officers of higher rank than Lieutenant in the Engineer Branch of foreign Navies. The Bill proposes 103 of the three higher grades and 200 of the lower grades, which is out of proportion to the relative essential duties required on board ship. Efforts to create large numbers of officers of high rank are detrimental to the service, unless the necessity of the creation for appropriate duties is apparent. But here we have a proposal for 103 officers, while 26 only of the corresponding ranks of the present Engineer branch are now employed at sea.

The great trans-Atlantic lines, running the famous greyhounds of the sea, are managed upon the principle of the greatest efficiency at the least expense. Years of experience are at the foundation of this system of management, and yet we find here again an engineer force of but few *officers*, with a large number of *subordinates* of practical experience in managing the machinery, the schooled Engineers having a general supervision over the work.

5. Educated Engineers and practical Machinists.

While this policy was yet undeveloped in the British Navy, an Engineer Journal (The Engineer, London, July 10, 1891,) advocated it in a leading editorial, from which the following is quoted :

"It appears to us that the scientific attainments of the naval engineers are simply costly superfluities. We arrive at this conclusion by a direct process of analogy. In the first place, a steam engine does not know whether it is in a man-of-war or an Atlantic liner. It has no respect whatever for the Admiralty or the articles of war; and what is good or bad for it in a passenger or cargo ship is good or bad for it in a man-of-war. This being the case, it further—by analogy—seems to be evident that the engineers who can successfully run our ocean steamships are equally competent to run a man-of-war. The only argument we have ever heard adduced to the contrary was that there were more engines on board of a man-of-war than there are in a merchant ship. To this statement, however, we take direct exception. Thus, for example, the 'Scot' has certainly twenty engines, of one kind or another, on board her; and when we get to twenty, a few more steam cylinders make very little difference one way or the other. In point of fact, we have never yet seen or heard an attempt made to prove that the engineers of the mercantile marine did not know all that need be known about the management and care of marine engines and boilers. Now it is no disparagement to say that we do not suppose there are more than half a dozen chief Engineers afloat at this moment who could pass an Admirality examination. We shall go further, and say that just the same statement holds good of the superintending Engineers of our mercantile fleets. Yet we have only to look at the position of our mercantile steam navy to-day to see how admirably the existing system has worked. The Admiralty, for some reason, the nature of which we quite fail to understand, has gone in for science in the wrong place; and, finding that comparatively high mathematics and a great deal of science did not, after all, qualify a man to take charge of very costly machinery, were driven to establish the class known as engine-room artificers; and it is very commonly reported that the artificers really do the work, and that the Engineers are superfluous. Of course this is not all true, but we are disposed to believe that there is a great deal of truth in it.

" It must be clearly understood that we are not in any way depreciating the merits or the abilities of the Engineers of the Royal Navy. On the contrary, our contention is that as far as can be seen they are a great deal too good for their work. What would be thought, for example, of a railway company which insisted that all its engine drivers must not only be skilled mechanics, but well up in the calculus and thoroughly versed in thermodynamics as well, or to put the matter closer, what would be thought of the board of trade if it substituted examinations based on the education of the Admirality type for that now used in passing chief Engineers? That a high scientific education may be a very good thing no one—we, ourselves, least of all—disputes. But there is a place for everything; and an engine-room is not the place in which scientific attainments are of any real value. That there ought to be in the Navy a few Engineers of eminent attainments we are certain, because such men would have ample scope for the exercise of their powers in designing machinery, preparing specifications, or dealing with specifications and proposals made by contractors for engines and boilers, etc. But their place would be on shore at our principal dockyards. They would fill, in short, much the same position as that occupied by the superintending engineers of the mercantile marine. As for manning the engine rooms of the Navy, there would be no difficulty about that, if only the Lords of the Admiralty would abandon the highly scientific theory and rest content with the attainments which have satisfied every demand of the mercantile marine. No shadow of proof has ever been vouchsafed that this educational system of the Admiralty is the best, or nearly the best, for the end in view. It remains to be seen now if any of the Admiralty Engineers can show that they have not, to all intents and purposes, wasted their time in acquiring information that they have no opportunity of utilizing in any way. Half the discontent which exists among Engineers in the Navy is due to the fact that the men eat their hearts out, feeling as they do, that their education has as far as possible unfitted them for the life they are driven to lead. They have been educated for one level and are compelled to live at another."

Some years before Sir Thomas Brassey, of the highest authority on naval organization, had said in the House of Commons:

"It remained to be considered whether the appointment and professional instruction of the Engineers of the Navy left anything to be desired. It seemed to him that too many highly educated men were employed in the engine-rooms of our men-of-war. Skilled mechanics would perform the duties as well, if not better, and they would not feel the social disadvantages of the junior grades of Engineer officers nor the same discontent at the want of promotion.

* * * * * *

Engine-room artificers (machinists) have become more and more essential on board ships fitted with the complicated appliances introduced into the later ironclads. They ought to be operative mechanics of the highest class.

A certain proportion of the appointments (to machinists) should be given to individuals coming with satisfactory recommendations from the great engine makers."

6. System in the United States Navy.

The views quoted lie at the base of the organization of our own engineer force, and we now have a valuable body of machinists who run the engines and boilers of our ships, under the supervision of the Engineer officers. The Navy does not need a greatly enlarged force of the latter, but the number and condition of the Machinists should be increased and improved.

In the British navy vessels of heavy tonnage have on board one Chief Engineer, one Engineer, 3 Assistant Engineers, 2 Chief Engine-room Artificers, 11 Engine-room Artificers, and 6 Stoker Mechanics. In flag ships, one or two more Engineers are on board for fleet duties.

In our ships, like the "Indiana" and "Texas," there are one Chief Engineer, 2 Passed Assistant Engineers, 2 Assistant Engineers, 8 Machinists, 2 Boiler-makers, 2 Coppersmiths and one Blacksmith. In our smaller vessels we have more educated Engineer officers than in similar vessels in any foreign Navy.

An additional number of commissioned officers on board ship, as this Bill proposes, means, too, an additional amount of space for officers' quarters, and yet the economy of space for the large crews of our new war vessels is one of the most troublesome points in designing those vessels.

7. Increase of rank and pay for the Bureau Chiefs.

Section 1 requires an additional expenditure of eleven thousand dollars ($11,000) for the Chief of the Bureau of Engineering and two Assistants. It provides for a Chief of the Bureau of Engineering with the rank of Rear Admiral and two inspectors-general of naval engineering of the rank of Commodore, who, by Sections 4 and 5, are to be assistants to the Chief of the Bureau. It is not claimed that the present rank is insufficient to enable the Chief of the Bureau to perform efficiently all his duties and to insure him the respect due to his position. There is neither reason nor need of establishing such high rank in the person of any assistant and its possession would lead to many controversies. It is observed that by the proposed bill the title of the Bureau of Steam Engineering is changed to that of the Bureau of Engineering. The reason for the proposed change in the title of the Bureau is not apparent. The officers of the Engineer Corps are not Mining Engineers, nor Civil Engineers, nor Electrical Engineers, but Steam Engineers or Marine Engineers.

By existing law, the Bureau of Navigation, the most important one, has a Rear Admiral as Chief, and a Commander in the Navy as Assistant. All the other bureaus, seven in number, have Chiefs of the relative rank of Commodore. Two of them have assistants of the rank of Lieutenant Commander. Five bureaus have no assistants. The proposed law would give to one bureau three officers with more than treble the rank and pay now assigned to one and to discharge the duties now performed by one. By a similar provision for the other equally important bureaus, the Navy Department would have for Chiefs and Assistants of Bureaus eight Rear Admirals and sixteen Commodores.

8. **Proposed selection of Bureau Chiefs objectionable.**

Section 2 provides that the Chief of the Bureau and the two assistants shall be selected from officers not below the rank of Lieutenant-Commander. This would be unwise. Similar officers of other bureaus who are given the temporary rank of Commodore, are by law, chosen from officers not below the rank of Commander.

9. Withdrawal of powers of the Secretary of the Navy.

Section 3. The Chief of the Bureau of Engineering should be simply an accomplished steam engineer, and his duties have no relation to the policy of the Navy. The mandatory clause assigning him to a naval board restricts the just powers of the Secretary of the Navy. No similar mandate exists as to any other officer of the Navy, and its action is contrary to the subordination which makes all officers subject to the orders of the Secretary of the Navy. If the Chief of one Bureau be made a permanent member of Boards, why should not the Chiefs of other important Bureaus be so appointed and all alike withdrawn from designation or control by the Secretary of the Navy?

10. Creation of a second Bureau of Personnel.

Sec. 3. The Bureau of Navigation now has charge of the promulgation and record of all orders of the Secretary of the Navy to officers and enlisted men and of all orders for the movements of ships. Its duties comprise also the enlistment and discharge of all enlisted persons and the record of their services, upon which, in part, depends their pensions. It has many other duties which, like those stated, have no legitimate connection with the Bureau of Steam Engineering, but are necessarily concentrated in the one office by which the Secretary of the Navy wields the Navy as a military weapon. The section would erect a second office to control a part of the personnel of the Navy, viz: Engineer officers and enlisted men. There would be two offices from which orders would issue to the vessels of the Navy and to navy yards concerning the transfer of officers and men. There would be two offices of records of service, governing pensions, each with its own methods. This would be a distinct reversal of the policy of simplification and concentration which is essential to efficiency in a naval organization. A similar office would as reasonably be instituted for the control of the Medical Corps, and another for the Paymasters' Corps, each under the appropriate Chief of Bureau. The disintegration of the Navy as an effective fighting organization would then be pretty complete.

11. **Extensive transfer of duties of other Bureaus.**

Section 3. The term "engineering material" is a comprehensive one, and undoubtedly includes much that is now under the direction of other bureaus of the Navy Department. The section must be construed as directing the transfer to the Bureau of Engineering of the gun shop and the torpedo station now under the control of the Bureau of Ordnance; of the dry docks, derricks, shears, railway tracks and cars, fire engines, reservoirs, tools, and other material now under the Bureau of Yards and Docks at the Navy Yards; of the manufacture of ropes and chain cables, the installation and repair of all electric appliances on board ships, and other material now under the Bureau of Equipment; of the capstans, windlasses, stearing gear, ventilating apparatus and other material for ships now under the Bureau of Construction and Repair. The section would relieve the Secretary of the Navy of the duty now imposed upon him of distributing the business of the Navy Department among the bureaus in such manner as he shall judge expedient and proper. The great gun shop, the manufacture of great guns and torpedoes, are certainly engineering works, involving designing and the use of engineering material, and they have been designed and perfected by Line officers. This is true also of the work and duties of officers of other branches of the Navy. The Bill seeks to draw all these things into the Bureau of Engineering, abolishing the principle of giving to officers of the Line a practical part in the design, manufacture and inspection of the machinery which they use on board war vessels.

12. Duties of Inspectors-General unnecessary.

Section 4. It has been shown already (Sec. 1) that the officer whose duties are prescribed herein is unnecessary. The duties are equally so. Such experiments in marine engineering as are desirable are now conducted by boards of officers appointed for the purpose. In electrical and mechanical science and practice, the private establishments of our country lead the world and furnish the Navy with all the knowledge and material it needs. At present the Navy has but one Engineer employed as a college professor, and he is stationed at an Agricultural College without benefit to the Navy.

The provision that the officer shall be a member of the speed trial board of vessels restricts the powers of the Secretary of the Navy.

13. Extensive expansion of Duties of Bureau.

*Section 5, lines 7 to 13, concentrates in the Bureau of Steam Engineering a great many duties which are now distributed by the Secretary of the Navy to other bureaus. It would put the Bureau of Steam Engineering practically in control of some part of every branch of the Navy. It comprehends about every mechanical appliance used by officers of the Line on board ship; as for example, apparatus for electric firing of guns, signal and search lights, navigating instruments, and not excepting a patent fog horn.

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*He shall have charge of the selection of the various auxiliary mechanical appliances required for naval purposes which are not designed by the Bureau of Engineering, and shall make such experiments from time to time as will secure for the naval service the highest types of such machines for installation aboard our war ships.

14. **Change in examination of officers.**

Section 6. It is not apparent why officers of the Engineer Corps who served in the civil war should be exempt from examinations to which the officers of other branches having similar war service are subjected.

Section 7. The proviso would have the extraordinary effect of preventing the board from considering reports presented under regulations of the Navy Department, and of preventing the Navy Department from prescribing rules as to such reports.

15. **Proposed change in organization on board war vessels.**

Section 8 would transfer important duties on board ship to the Engineers and render necessary not only an increase of Engineers but a great enlargement of the Engineers' force. The hydraulic, pneumatic, and electric appliances are closely connected with the guns, gun mounts, and electric lighting and signaling apparatus. All these have been developed and brought to perfection under the Bureau of Ordnance, Bureau of Construction, and Bureau of Equipment, and they are worked by officers and men of the Line in handling the ship and her guns. These officers are the Watch and Gun Division officers, who are indispensable to the ship. The section would relieve them of these important duties, to provide work for the increased force of Engineers demanded by Section 1. Since the Watch and Gun Division officers cannot be withdrawn from the ships, the result of the transfer of these duties would cause a greater number of officers for the same work than at present. It should be remembered that the instruction of officers of the Line in electricity, hydraulics, pneumatics and torpedoes, and practice in the machine shops at the Naval Academy and torpedo school prepare them for handling these various types of machinery and appurtenances by which the guns are used. The guns and gun mounts of the Navy have all been designed or approved and accepted by these officers, and they are in efficient control and management by these officers to-day. It may be said justly that the naval guns of the United States have no superiors in the world. Instead of transferring these duties, as suggested, the correct naval system of organization is to encourage the officers who fight the guns to study and master the machinery they must use. The Engineer officers now control a very large part of a ship, wherein is installed the propelling machinery, which should engage all their attention.

16. **Transfer of duties of inspection and purchase.**

The inspection of material for new vessels is under the control of a board acting directly under the orders of the Secretary of the Navy. It provides an inspection by officers of several branches of the Navy, including Engineer officers, but not excluding others. In other words, the inspection is not solely by officers under the bureau which incorporates the material into the vessel, a system which is good in policy and has proved effective. There is no reason for relieving the inspectors of steel appointed by the Secretary of the Navy.

The purchase of coal at home is now well done by contracts executed by the Bureau of Equipment. Abroad coal is bought for ships by the Paymaster, and after inspection and tests by the Engineers, under the direction of the Commanding Officer. The transfer of these duties to the exclusive control of the Bureau of Engineering at home and the Chief Engineers of ships abroad, cannot improve the efficiency of the Engineers nor the organization or effectiveness of our war ships. It would withdraw from the Secretary of the Navy a part of his power of assigning the duties of the Navy, and from the Commander of a ship abroad his control of the Paymaster and Chief Engineer in making purchases of coal.

17. **Further restriction of naval authority.**

Section 9 further restricts the powers of the Secretary of the Navy and of the Commanding Officers of fleets and war vessels.

18. **Change of titles** (Sec. 1) **and division of command** (Sec. 10). **A dangerous change of organization of the Navy.**

All commissions of officers of the Navy, whether of the Line or Staff, are identical in language in the following clause:

> * * * "And I do strictly require all officers, seamen and marines under his command to be obedient to his orders as—(rank here entered.)" * * *

All the disciplinary authority required by the Engineer officer or any other officer, for the proper management of those under him, is vested in him by the commission which he holds, regardless of rank or title. Authority attaches to the office and not to the title. In every department on board ship there is now, and always has been, complete organization and discipline. If it had been otherwise, the condition of affairs in our engine-rooms since the days of the "Fulton," our first steam war vessel, would have been deplorable. A lack of discipline does not exist, never has existed and never could be tolerated for one moment in a war vessel of this or any other government.

The present titles of naval officers not only show the official status and relation of individual officers to each other in the same corps, but are distinctive as indicating the nature of the duties they perform, which would not be the case were those titles changed as proposed. This statement applies with equal force to all corps of the Navy. In the merchant service it would be considered absurd for the Chief Engineers, Surgeons, or Pursers to demand the titles of the Captains and Mates of those vessels in place of their own, and yet this is just what the Engineers of the Navy seek by Section 1 of this Bill.

By authority of the Act of Congress approved March 3, 1871 (Statutes at Large, Vol. 13, page 537), an aid or executive of the Commanding Officer of every war vessel is assigned by the Secretary of the Navy. This aid or executive is, whenever practicable, next in rank to the Commanding Officer. He has no independent authority as such aid. His duty is to convey the orders of the Commanding Officer to all officers and men and to assist the Commanding Officer in executing all orders. In case of the absence, illness, or death of the Commanding Officer, the aid or executive, as the senior Line officer present for duty, becomes the Commanding Officer.

The Lieutenants on board a war vessel keep watch on deck and represent the Commanding Officer, when he is not on deck, in directing the movements of the vessel. In emergency or for any proper reason, he may ring the bell for the engines to stop, or call through the voice tubes an order to back the engines, and that order must be obeyed by the Engineer in the engine-room, even though he be senior in rank to the officer issuing the order. The law says that the order shall be regarded as emanating from the Commanding Officer. It seems hardly necessary to explain further the essential nature of the duties of the executive officer and officer of the deck, as representative of the Commanding Officer, and the paramount importance of investing them with sufficient authority to carry out the orders of the Commanding Officer. These officers are common to all war ships, and, indeed, under other titles, to all merchant vessels. So also the titles provided by existing law are similar to those in all marine services. No vessel has more than one Captain nor more than one Chief Engineer, but in all vessels titles indicate the duties of officers. This appropriate custom should have the continued sanction of law. If the titles of Line officers (of the Executive branch) be given to Engineer officers, they must be conferred also on other Staff officers; then in time of war when Staff officers of the rank of Captain are detailed for sea duty, we would have as many as five Captains on board of a flag ship. From the similarity of uniform, these Captains could not be distinguished except by inquiring of which part of the ship each is Captain.

Section 10 strikes at the root of all discipline on board ship. Its indefiniteness is misleading, but it is clear that as the Engineer officers have full authority to secure the execution of such orders and directions as they may give for the proper management of their department, the *command* which they desire over the force under them is *exclusive command.* This would practically give each ship more than one Commanding Officer, and the disastrous effect upon the discipline must be obvious to every one.

The present laws of the Navy give to the Commanding Officer of a vessel supreme command, and in him only lies the power of investigating offenses and inflicting punishments. The violation of any legal order given by an Engineer Officer in his own department is punished in the same manner as if given by the Commanding Officer himself, for, by law, all orders originate with him, and he only is responsible for the discipline and condition of the ship in every department. If his right and duty be taken from him in the least degree, responsibility is divided, and confusion results.

The section would make the senior Engineer officer of a ship responsible for the discipline, instruction and training of the enlisted men of the Engineers' division. The Commanding Officer now has that responsibility.

Under the orders of the Secretary of the Navy, enlisted men of the Engineers' force are now instructed at suitable times by the Lieutenants in charge of gun divisions in the use of boats and in handling the guns, rifles and revolvers, and by the officer of the powder division in handling powder, and by the Surgeon in use of tourniquets and aids for wounded. The section would give the senior Engineer charge of these varied instructions, which would be manifestly wrong.

The object of the section comprises also a release of Engineer officers and men of their division from any orders of the executive officer or officer of the deck, in carrying out the directions of the Commanding Officer. **This is the kernel of the section.** There is to be another aid or executive of the Commanding Officer for the Engineer department, and another officer in the engine-room junior to the Chief Engineer, who is to be the representative of the Commanding Officer in the engine-room, as the officer of the deck is in another part of the ship. The officer of the deck has now control, in the absence of the Commanding Officer from the deck, of the entire ship. He can now order the Engineer to close the collision doors or to start the fire pumps and turn on water. Under the law proposed in Section 10, such a message from the officer of the deck could be regarded by the Engineer in the engine-room as one which he could respond to [illegible] manifest that such a [illegible] with necessary [illegible] become a judge [illegible] him.

The Executive officer now submits a record daily of all matters connected with the crew, their leaves, conduct, messes, etc., and he arranges the details of all expeditions to leave the ship on naval service, and performs many duties of organization under the general directions of the Commanding Officer. Section 10 would divide these duties and make a second military organization comprising the Engineers' force. It is not possible that under such a system there could be that unity of arrangement and concentration of purpose and direction which is essential to all military plans in a vessel of war. And if there be such a division of authority and system for the Engineers' force, it must be applied also to the Surgeon's force and the Paymaster's force. The section is the correlative for war vessels of the system provided by section 3 for the Engineers on shore. The two sections would form for the Engineer Corps a little Navy of its own, largely independent of other parts of the Navy.

Section 17 goes further and contemplates that Engineer officers may command in other corps of the Navy.

These sections are full of danger to the efficiency of the Navy. By law, only officers of the Line, or Executive branch, can exercise military command. It is absolutely essential and inevitable that the military should dominate all functions on board of a war vessel, but above all the fighting and motive powers of the vessel. See The Influence of Sea Power on History—Mahan, pages 127 to 129.

The conclusion of the Committee on Naval Affairs of the last Congress on their investigation of this subject is stated in House of Representatives Report No. 1573, Fifty-third Congress, third session, page 12. Again, on page 18 of that report, it is said:

"It is thought best that the present military organization should not be changed, for it must be remembered that the authority of the Commanding Officer of a man-of-war is, and should be, supreme on board of his ship. There must be no conflict of authority here, and in order to carry out the military duty incident to the naval service, his authority, when not present in person, must be delegated to some subordinate, who shall be responsible to him for the safety and discipline of the ship."

This discussion is closed with the following quotation from the views of a distinguished Engineer officer of the British Navy, as follows:

"Some Engineer officers advocate that all the members of the class should be made executive officers (corresponding to Line officers in our Navy). From the Engineer officers' point of view, it is probable that this would be unobjectionable, but it is doubtful whether the change would, in the end, benefit either the class or the Navy at large. There is much sentimental talk indulged in on this subject, such as, *e. g.*, that civil officers, having no executive authority, cannot legally maintain the discipline of any department of which they have charge; also, that the youngest midshipman can give an order to the most senior fleet Engineer, which the latter would be bound to obey, and such like. Now, any one with practical experience in the Navy, must know that there is no force in these arguments, and that any grievances on these grounds are non-existent. It is absolutely necessary that the senior executive officer should be in supreme command. Anything in the nature of a divided command cannot but result in confusion, and would seriously impair the good order and discipline which should obtain in every commissioned ship of war. The conferring of executive rank implies the exercise of executive functions, including command; and this, in the case of the Engineer class, is of course neither expedient or necessary. It is not called for in any way. No engineer officer of sound judgment and practical experience can find the least difficulty, as a non-executive, in maintaining the good order and discipline of his department. Therefore, any supposed grievances which are caused by the

Engineers not being executive officers are in the highest degree unreal and sentimental. These officers have their hands full in attending to the efficient administration of their departments, and need not concern themselves in trying to get executive rank, from which, if conferred, it is very doubtful if they, as a class, would derive the least benefit, and which it is still less likely would benefit the Naval Service. These opinions of a non-executive officer are based on an experience gained during nearly forty years' active service, during which no difficulty of any kind in carrying out his duties, as regards the maintenance of the discipline of his department, has at any time been met with, and it should be noted here that he has had sole charge of the steam departments of the ships in which he has served since he was twenty-four years of age."—The Steam Navy of England—By H. Williams, Chief Inspector of Machinery, British Navy, London. W. H. Allen & Co., 1893.

19. **Retirement of Engineer Officers as Commodores.**

Section 11 of H. R. Bill 3618 would retire nearly all Engineer Officers as Commodores. The section would cause a great increase of expense of the retired list.

20. **Increase of Cadets at the Naval Academy, and cost thereof.**

By Section 12, the number of Cadets at the Naval Academy will be increased as follows, the additional cost being stated opposite :

First year	47 Cadets	$28,600
Second year	94 Cadets	57,200
Third year	141 Cadets	85,800
Fourth year	187 Cadets	113,883

The additional Cadets to be maintained at 187 until the Engineer Corps is filled to 303 in number, when the Cadets will be reduced to 94 at a cost of $57,200 per annum.

Section 13. Beginning on the 30th of June following the passage of the Act, the Cadets just graduated at the Naval Academy and graduates from technological schools are to be appointed Engineer Cadets in the Engineer Corps of the Navy to the number of forty annually. This will give forty such Cadets the first year after the passage of the Bill at a cost of $42,000. The next year there will be eighty such Cadets at a cost of $80,000. The senior of these classes will be on sea pay (except the ration) while receiving instruction on shore. Section 14 provides this sea pay. Sea pay on shore duty!

This is to continue until the Corps is filled with commissioned officers, when the number of these Cadets outside of the Naval Academy will be reduced to about fifty at a cost of $50,000 per annum.

The maximum cost of sections 12, 13 and 14 for the support of these Cadets exceeds $190,000, and the minimum cost exceeds $100,000.

In addition there is to be a gratuity of one year's pay to honorably discharged Cadets, some of whom will have been under instructions but two years and will thus receive $2,950 each for two years' study (Sec. 14).

21. Small number of commissioned Engineers from technological schools and colleges.

There are now in the Navy and at the Naval Academy about 75 Naval Cadets who will become available within a few years for appointment to the lowest commissioned grade of the Engineer Corps. By section 20, twenty-five of these are to be commissioned upon the passage of the Bill, which will raise the number of commissioned Engineers to 198. There remains 105 to be supplied, plus the annual waste, which, for the next ten years is estimated at less than 10 annually. The retirements for age (60 years) will not be more than half that number. The commissioned officers of the Corps can then be filled to the number of 303 by the proposed system in five years, though the process might be extended to six years. The year following there would be one class of Engineer Cadets 40 in number, another of about 25, and at the Naval Academy about 145 Cadets, out of which to supply an annual waste not exceeding 12. It would take three years more to reduce the Engineer Cadets in and out of the Academy to the minimum number of 145.

As one-half the commissioned officers are to be appointed from graduates of the Naval Academy, the total number of graduates of all technological schools and colleges in the country offering candidates who could be commissioned up to the time the vacancies shall be filled could not exceed seventy-five or eighty. With 187 Cadets at the Academy, classes as large as 30 may be graduated and be appointed Engineer Cadets in the Engineer Corps. That would leave but ten appointments annually from colleges, and the number from colleges would fall far below that stated as the maximum. As the supply from the Naval Academy is already operating, any delay in filling the vacancies would cause advantage to the graduates of the Naval Academy to the partial exclusion of those from colleges.

This discussion disregards the provision for giving commissions to enlisted men (Sec. 14). Enlisted men could not successfully compete, under the stated conditions, with graduates of the Naval Academy and colleges. The plan for advancing enlisted men is a hollow mockery.

After the commissioned grades of the Corps are filled, the number of graduates of colleges appointed annually as Engineer Cadets is to be equal to the excess of the existing vacancies (at the end of a year) over the number of those Engineer Cadets finishing the four years' course at the Naval Academy. Any one tracing out the result by arithmetic, will find that no appointments will be made from the colleges; for the waste, or vacancies made, will not exceed 12 per year. But supposing 75 per cent. of the Cadets entering the Naval Academy to fail in getting commissions, there would be left about six commissions annually for the colleges. One small college could supply not half, but the entire, waste. The graduates of the Naval Academy cannot now get commissions in the Navy. Some of them are honorably discharged annually.

It seems very clear that the aid this Bill would give to colleges in maintaining classes in marine engineering is not of a substantial nature nor of encouraging amount.

By section 14 it is contemplated that Engineer officers shall be assigned as professors in colleges. This is another example of finding duty for the increased number of officers demanded by section 1. What the Navy needs is an efficient organization of Engineers for a war basis, and not a scheme for enlarging the number for the benefit of schools and colleges. But the support of the schools and colleges is necessary to the scheme of increasing the importance of the Engineer Corps. The Bill holds out to the schools and colleges the hope of securing places in the Navy for their graduates. It is a matter of business as well as of interest in education. But, as already shown, the appointments from sources other than the Naval Academy would be few and soon cease altogether. There are now Naval Cadets numbering about 75 who will be eligible for appointment as Engineer officers, and the Naval Academy is a splendid school of physical and professional training which is maintained to fit young men from all parts of the country for the Navy. The Engineer Corps would soon be filled. The waste of a body of 300 men serving each during 40 years does not exceed 12 a year, which the Naval Academy can readily supply, leaving no places for students from colleges.

But the interest of the colleges is desired in this scheme, ostensibly for their benefit, but really for the promotion and increase of importance of Engineers of the Navy. The following circular letter illustrates the working of this branch of the scheme:

West Virginia University,
Morgantown, W. Va.

Dear Sir: Your attention is respectfully invited to the educational features of the Wilson-Squire Naval Engineering and Education Bills, now before Congress. They have been presented in the printed matter previously sent you or accompanying this letter. Especially important are the provisions outlined under sections (A) and (B) of the accompanying circular.

The bills are now in the hands of the respective Naval Committees. The engineering, educational and State industrial interests involved, as well as the far-reaching results of these provisions, should be urged upon the attention of these committeemen by all colleges and other institutions interested in the passage of these bills.

Earnest and concurrent solicitation of their respective Congressmen by the authorities of all such colleges is quite as essential as the concentration upon committee work by the institutions in those particular States whose Congressmen are on the Naval Committees. There is no time so opportune as the present in which to bring this matter to the attention of our respective Congressmen. The bills will probably be acted upon some time in February. It is necessary to lay all of the arguments clearly before our Senators and Representatives at as early a day as possible, that such important measures may not go by default through any misunderstanding of their provisions.

The desirable *educational features* cannot be obtained by urging Congressmen to support these items alone. Each bill must be examined and advocated as a whole. Only as a whole can the several parts be properly correlated, rightly understood and intelligently voted upon.

All scientific and technological schools and colleges may become beneficiaries of the endowment and support of the courses in naval engineering which these bills contemplate. Such institutions in each State can promote very materially these measures by petitioning their Senators and Representatives in Congress to give unanimous support to the Squire and Wilson bills, respectively. It would be well to accompany such a petition with a memorial, urging them to add a few remarks in favor of the bill, in the light of such memorials, when presenting the same in the halls of Congress.

Petitions, memorials and arguments, as well as remarks upon introducing the same, will be published in the Congressional Record. Also, the whole matter will very probably be published as a Miscellaneous Document.

It is certainly one of the most comprehensive measures for the promotion of engineering education and the consequent industrial development of the several States which has yet been presented. If it becomes a law it will rank in importance with the Land Grant Act, of 1862, and the Morrill Bill, of 1890, but bestows its benefits upon a greater number of scientific schools, colleges and universities than contemplated or provided for by either of the former bills.

In this connection we specially call your attention to what the bill proposes to do for the young men who shall graduate from such courses as well as for the institution which has thereby become recognized as a proper fitting school for the Naval Engineering service of the Government.

Very respectfully yours,

J. L. GOODKNIGHT, D. D.,
President of the West Virginia University.
WM. S. ALDRICH, M. E.,
Prof. Mechanical Engineering.

Jan. 30, 1896.

The circular says that: **"The desirable *educational features* cannot be obtained by urging Congressmen to support these items alone. Each bill must be examined and advocated as a whole."** The interests of the Navy, or of any part of it, ought not to be coupled with any plan by which "All scientific and technological schools may become beneficiaries of the endowment and support of the courses in naval engineering which these bills contemplate."

The first part of the last paragraph of the circular letter has been shown already to be impracticable.

22. No models nor machinery for colleges.

Section 15. There is at the Naval Academy a collection of models of machinery, the value of which is in part historical. Excepting plans of machinery of naval vessels, there are no models, plans and machinery which could be spared with or "without detriment to the naval service." Such models and machinery would have to be manufactured or bought at great expense. This section is a part of the plan by which schools and colleges are to be induced to apply to Congress to pass this bill, so dangerous to the organization and discipline of the Navy. It offers inducements which do not exist and must be created.

The idea of the scientific institutions giving the Navy a corps of trained men as naval engineering reserve is misleading. The proper place to train men is afloat in engine-rooms and fire-rooms on board of vessels through all the changes of a rolling sea.

23. Impracticable rules of precedence.

Section 16. This section is different in the Bill H. R. 3618 and Senate 735. The Navy has now one rule of precedence as between the Line and Staff and another rule between the Line and Army or the Marine Corps. The section would introduce other rules of precedence which are impracticable. The Bill H. R. 5215 provides the only reasonable rule of precedence, according to date of commission in the same rank.

24. No scarcity of Naval Engineers.

Section 20. It has been shown already that there is no scarcity of Naval Engineers nor any probability of such scarcity.

25. Naval Experiment Station.

Section 21. No such naval engineering experiment station now exists in the world. The development of modern engines of great power has been economically accomplished everywhere by private firms. The fine engines of our war ships, as well as those of foreign countries and of merchant vessels, have been made successful without any costly experimental station. Compound engines, triple expansion engines, and quadruple expansion engines were all experiments, and every ship is an experiment on a scale of actual performance. Trials of ships and study of their working is the highest type of experiment and they require no naval station of expensive plant and large staff of officers and men with suitable buildings. Five thousand dollars would be a mere drop in the expense of creating a station of experiment, which is unnecessary and would be useless.

26. Increase of pay of officers.

Section 22, H. R. 3618. The Senate Bill 735 omits a provision for pay. But it provides that the Engineers shall have the titles of the Line Corps. As the pay of the latter is now in every grade lower than the corresponding grade of the Engineer Corps, the section was introduced in the House Bill in terms to increase pay of the grades of Commodore, Captain and Commander in both corps, but retaining a higher grade of pay for some of the Engineers (by the last clause of the section) than given to the same rank in the Line Corps. The Engineers seek the titles, but are not willing to accept the pay of the Line Corps. All the Junior

Engineers are to be promoted and receive an increase of pay. Everybody in the corps is taken care of liberally.

The cost of this section in increase of pay of the active list is about two hundred and forty-five thousand dollars ($245,000) per annum, for the Engineer Corps, as increased by section 1, and about forty-six thousand dollars ($46,000) per annum for officers of the Line Corps. The cost of the bill per annum will range between four hundred and fourteen thousand dollars ($414,000) and five hundred and one thousand dollars ($501,000), according to the changes in the additional number of Cadets.

This estimate does not include the cost of building up an experimental station nor of providing models and machinery for colleges, nor does it include the gratuity to Cadets honorably discharged under the provisions of Sec. 14, nor the increase of the pay of the retired list under Sec. 11.

27. Conclusion.

This Bill was not originated by the colleges, technological schools or scientific institutions of the country, nor was it got up for their benefit. The only measure in it which would benefit such educational institutions would be the assignment of officers as professors at the expense of the Government. No measure for the benefit of education at large should be linked to one designed to advance the fortunes of individuals or of any body of men; and much less should it be used to urge through Congress a law affecting the fundamental organization of the Navy.

This Bill was designed to do a great deal to elevate the rank and pay of Engineers of the Navy. It was designed also to elevate the Engineer Corps in control of the Navy; and, in doing so, to abolish the existing system of organization and discipline of the Navy, which is similar to that of all navies and has proved effective in peace, in war, and in every emergency.

Navy, and where an officer of the Engineer Corps of the Navy is detailed; he shall make such reports as will show their usefulness and efficiency to the Naval service. He shall be a member of the speed-trial boards, which shall recommend whether vessels built by private firms shall be accepted by the Government. He shall prepare such forms and books of instructions as will aid the officers of the Engineer Corps in the more efficient performance of their duties. He shall also perform such duties as may be assigned him by the director-general of naval engineering.

SEC. 5. That the junior inspector-general of naval engineering shall be detailed as assistant to the chief of bureau of engineering. That the duties of the junior inspector-general of naval engineering shall be under the direction of the chief of bureau of engineering, as follows: He shall have the general supervision of all construction and repairs under cognizance of the bureau of engineering. He shall have charge of the selection of the various auxiliary mechanical appliances required for naval purposes which are not designed by the bureau of engineering, and shall make such experiments from time to time as will secure for the naval service the highest types of such machines for installation aboard our warships. He shall make periodic visits to the several industrial plants where such machines for naval purposes can be built, and shall also visit modern merchant vessels. He shall submit detailed reports to the director-general of naval engineering in regard to the efficiency of the various types of such machinery and as to the best manner of their installation. Under his direction there shall be prepared monograms upon subjects relating to the naval engineering profession, which shall be furnished free of cost to all students who are pursuing a course of engineering which shall fit them for appointment as engineer cadets.

SEC. 6. That every officer of the Engineer Corps shall be required, before promotion to the next higher grade, to pass the examination now provided for by section fourteen hundred and ninety-three of the Revised Statutes, All except those who served in the civil war shall also be required, before promotion to the next higher grade, to pass the examination now provided for by section fourteen hundred and ninety-six of the Revised Statutes, as amended by the following section.

SEC. 7. That section fourteen hundred and ninety-six, Revised Statutes, be, and is hereby, amended by the addition of the following proviso:

"*Provided,* That the aforesaid board shall be composed of officers of the same corps as that of the officer to be examined, and that no records than those which may be on file in the Navy Department from commanders in chief, commanding officers, and senior officers of the same corps as that of the officer being examined shall be accepted as evidence in determining his mental and professional qualifications."

*SEC. 8. That the title "Bureau of Steam Engineering of the Navy Department" is hereby changed to "Bureau of Engineering of the Department of the Navy," and it shall have charge of all that relates to the designing, building, installation, fitting out, repairing, and management of all

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*SEC. 8 (S. 735).—That the title of the Bureau of Steam Engineering of the Navy Department is hereby changed to the bureau of engineering, and it shall have charge of all that relates to the designing, building, installation, fitting out, repairing, and management of all main and auxiliary steam, hydraulic, pneumatic, electric, and other machinery and their appurtenances used on board of naval vessels, not including gun carriages, torpedoes, torpedo tubes, and fittings.

That the bureau of engineering shall hereafter have control of all matters relating to the purchase, inspection, character, and quality of coal, and of all other kinds of fuel to be used for all naval purposes; and that all tests of such fuel shall be made under the direction of the bureau of engineering.

54TH CONGRESS, 1ST SESSION, H. R. 3618.

IN THE HOUSE OF REPRESENTATIVES.

January 10, 1896.

Mr. WILSON, of New York, introduced the following bill; which was read twice, referred to the Committee on Naval Affairs, and ordered to be printed.

A BILL

To organize and increase the efficiency of the personnel of the Navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval-engineering reserve for time of war; to establish a naval-engineering experimental station, and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering in the technological colleges of the country.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the active list of the Engineer Corps of the Navy shall consist of eighteen captains, twenty-five commanders, sixty lieutenant-commanders, seventy lieutenants, sixty-five lieutenants of the junior grade, and sixty-five ensigns, and a number of engineer cadets, as provided by subsequent sections.

That these offices shall be filled by the commissioning of the officers of the Engineer Corps of the Navy borne on the active list at the time this bill shall become a law, in the order of seniority, beginning at the top.

That there shall be a chief of the bureau of engineering of the Navy Department, who shall be director-general of naval engineering; and while holding said office shall have the rank of rear-admiral.

That there shall be two inspectors-general of naval engineering, who while holding said office shall have the rank of commodore.

SEC. 2. That the director-general of naval engineering and two inspectors-general of naval engineering shall be appointed by the President, by and with the advice and consent of the Senate, from the list of the officers of the Engineer Corps of the Navy not below the grade of lieutenant-commander, and shall hold office for the term of four years.

SEC. 3. That the duties of the director-general of naval engineering shall comprise everything relating to the engineering material and personnel, and that he shall be a member of every naval board concerning the policy of the Navy.

SEC. 4. That the senior inspector-general of naval engineering shall be detailed as assistant to the chief of the bureau of engineering of the Navy Department, and in case of the death, resignation, absence, or sickness of the chief of the bureau, such officer shall, unless otherwise directed by the President according to the provisions of section one hundred and seventy-nine of the Revised Statutes, perform the duties of such chief of bureau until his successor is appointed or such absence or sickness shall cease.

That the duties of the senior inspector-general of naval engineering shall, under the direction of the chief of bureau of engineering, consist of designing and preparing the plans and specifications of all new machinery. He shall also have direct charge of all experimental research in connection with matters relating to the marine, electrical, and mechanical engineering sciences under the cognizance of the bureau of engineering. At least once every two years he shall visit those technological schools which shall have established a course of engineering satisfactory to the Secretary of the

Navy, and where an officer of the Engineer Corps of the Navy is detailed; he shall make such reports as will show their usefulness and efficiency to the Naval service. He shall be a member of the speed-trial boards, which shall recommend whether vessels built by private firms shall be accepted by the Government. He shall prepare such forms and books of instructions as will aid the officers of the Engineer Corps in the more efficient performance of their duties. He shall also perform such duties as may be assigned him by the director-general of naval engineering.

SEC. 5. That the junior inspector-general of naval engineering shall be detailed as assistant to the chief of bureau of engineering. That the duties of the junior inspector-general of naval engineering shall be under the direction of the chief of bureau of engineering, as follows: He shall have the general supervision of all construction and repairs under cognizance of the bureau of engineering. He shall have charge of the selection of the various auxiliary mechanical appliances required for naval purposes which are not designed by the bureau of engineering, and shall make such experiments from time to time as will secure for the naval service the highest types of such machines for installation aboard our warships. He shall make periodic visits to the several industrial plants where such machines for naval purposes can be built, and shall also visit modern merchant vessels. He shall submit detailed reports to the director-general of naval engineering in regard to the efficiency of the various types of such machinery and as to the best manner of their installation. Under his direction there shall be prepared monograms upon subjects relating to the naval engineering profession, which shall be furnished free of cost to all students who are pursuing a course of engineering which shall fit them for appointment as engineer cadets.

SEC. 6. That every officer of the Engineer Corps shall be required, before promotion to the next higher grade, to pass the examination now provided for by section fourteen hundred and ninety-three of the Revised Statutes, All except those who served in the civil war shall also be required, before promotion to the next higher grade, to pass the examination now provided for by section fourteen hundred and ninety-six of the Revised Statutes, as amended by the following section.

SEC. 7. That section fourteen hundred and ninety-six, Revised Statutes, be, and is hereby, amended by the addition of the following proviso:

"*Provided*, That the aforesaid board shall be composed of officers of the same corps as that of the officer to be examined, and that no records than those which may be on file in the Navy Department from commanders in chief, commanding officers, and senior officers of the same corps as that of the officer being examined shall be accepted as evidence in determining his mental and professional qualifications."

*SEC. 8. That the title "Bureau of Steam Engineering of the Navy Department" is hereby changed to "Bureau of Engineering of the Department of the Navy," and it shall have charge of all that relates to the designing, building, installation, fitting out, repairing, and management of all application and in the discretion of the President, be retired from active service and placed upon the retired list of the Navy with the rank and retired pay of the next higher grade.

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*SEC. 8 (S. 735).—That the title of the Bureau of Steam Engineering of the Navy Department is hereby changed to the bureau of engineering, and it shall have charge of all that relates to the designing, building, installation, fitting out, repairing, and management of all main and auxiliary steam, hydraulic, pneumatic, electric, and other machinery and their appurtenances used on board of naval vessels, not including gun carriages, torpedoes, torpedo tubes, and fittings.

That the bureau of engineering shall hereafter have control of all matters relating to the purchase, inspection, character, and quality of coal, and of all other kinds of fuel to be used for all naval purposes; and that all tests of such fuel shall be made under the direction of the bureau of engineering.

SEC. 12. That each Senator of the United States and each Delegate of the House of Representatives shall nominate candidates for appointment as engineer cadets at the United States Naval Academy in the same manner and under the same regulations as now govern the nomination and appointment of naval cadets by Members and Delegates of the House of Representatives.

That the President shall appoint one engineer cadet from the District of Columbia and three at large, as he now appoints naval cadets.

Until the number of officers of the Engineer Corps provided for in this Act is reached each Senator shall be entitled to have two cadets pursuing the prescribed course at one and the same time, but after that number has been reached but one cadet at one and the same time.

After the passage of this Act, at the date designated, the senior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy. At the same time in the following year the junior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy, and any vacancy in the preceding year's appointments shall be filled by the Senator who made the original nomination, or by his successor. The third year the senior Senators shall make their second nominations, and the fourth year the junior Senators shall make their second nominations, and thereafter whenever a vacancy occurs until the number of officers in the Engineer Corps has reached the limit fixed in this Act, when each Senator will be entitled to but one cadet pursuing the course at any one time.

tion with the engineering department of the vessel. He shall have no authority independent of the commanding officer, and in the performance of his duty shall be regarded as executing the orders of the commanding officer. The officer on duty in the engineering department shall be regarded as the representative of the commanding officer so far as the duties of the department are concerned, but he shall at all times be subject to the orders of the senior engineer.

*SEC. 11. That officers of the Engineer Corps of the Navy shall, after January first, eighteen hundred and ninety-seven, be placed on the retired list when they arrive at the age of sixty years, and officers so retired shall receive seventy-five per centum of the sea pay to which they are entitled at the date of such retirement as established by existing law.

Any officer of the Navy who has served or shall have served faithfully thirty years may, upon his own application and in the discretion of the President, be retired from active service and placed upon the retired list with three-quarters of the sea pay of his grade, and any officer below the rank of commodore who has served or shall have served honorably thirty-five years may, upon his own

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*SEC. 11 (S. 735).—That officers of the Engineer Corps of the Navy shall be placed on the retired list when they arrive at the age of sixty years, and officers so retired shall receive seventy-five per centum of the sea pay to which they are entitled at the date of such retirement as established by existing law. An officer of the Engineer Corps who has been thirty years in the service may, upon his own application, be placed on the retired list, and shall receive sixty per centum of his sea pay as established by existing law. The President may, upon the recommendation of the Secretary of the Navy, place any officer of the Engineer Corps who has been thirty years in service upon the retired list, and any officer so retired shall receive sixty per centum of his sea pay, as established by existing law: *Provided*, That the number of engineer officers retired by virtue of thirty years' service shall not exceed six in any fiscal year.

application and in the discretion of the President, be retired from active service and placed upon the retired list of the Navy with the rank and retired pay of the next higher grade.

SEC. 12. That each Senator of the United States and each Delegate of the House of Representatives shall nominate candidates for appointment as engineer cadets at the United States Naval Academy in the same manner and under the same regulations as now govern the nomination and appointment of naval cadets by Members and Delegates of the House of Representatives.

That the President shall appoint one engineer cadet from the District of Columbia and three at large, as he now appoints naval cadets.

Until the number of officers of the Engineer Corps provided for in this Act is reached each Senator shall be entitled to have two cadets pursuing the prescribed course at one and the same time, but after that number has been reached but one cadet at one and the same time.

After the passage of this Act, at the date designated, the senior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy. At the same time in the following year the junior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy, and any vacancy in the preceding year's appointments shall be filled by the Senator who made the original nomination, or by his successor. The third year the senior Senators shall make their second nominations, and the fourth year the junior Senators shall make their second nominations, and thereafter whenever a vacancy occurs until the number of officers in the Engineer Corps has reached the limit fixed in this Act, when each Senator will be entitled to but one cadet pursuing the course at any one time.

The Presidential appointments, one from the District of Columbia and three at large, four in all, and the nominations by the delegates shall be made each year, in each case, until the positions are filled, and thereafter whenever a vacancy occurs. The Secretary of the Navy shall designate the order in which the delegates from the Territories shall nominate their candidates. A vacancy in the above Presidential and delegate appointments occurring during these first four years shall be filled at the date of yearly appointments next following, in addition to the original appointments of that year.

From the passage of this Act until the class first appointed under its provisions shall enter its fourth year, appointments shall be made to the engineer division of the first class of naval cadets at the United States Naval Academy according to the laws in force governing such appointments previous to the passage of this Act, except that volunteers only shall be so appointed.

Sec. 13. That graduates of technological schools of the United States whose course of instruction in mechanical engineering may be considered satisfactory by the director-general of naval engineering, and approved by the Secretary of the Navy, may be eligible for appointment as engineer cadets in the Engineer Corps of the Navy.

That the appointment of engineer cadets in the Engineer Corps of the Navy shall be made from the engineer cadets of the United States Naval Academy at the end of the four years' course, and from the graduates of the beforementioned technological schools.

That on the thirteenth day of June after the passage of this Act, and yearly on the same date, and until the number of commissioned officers allowed by this Act has been reached the number of engineer cadets appointed in the Engineer Corps of the Navy shall be thirty plus the number of vacancies occurring in the Engineer Corps during the year preceding ending May thirty-first. After the number of commissioned officers herein provided for has been reached the number of appointments made on the thirtieth of June of each year shall be double the number of vacancies occurring in the lowest grade of commissioned officers in the Engineer Corps of the Navy during the year then ending.

Until the total number of officers in the Corps provided for by this Act is reached, the number of graduates of technological schools appointed engineer cadets, as above provided, is to be equal to forty, less the number appointed from the United States Naval Academy, and after this limit is reached to be equal to the excess of the existing vacancies over the number of engineer cadets of the United States Naval Academy available each year.

All applications for appointments from civil life must be made to the Secretary of the Navy on or before the first day of June of each year. Such candidates must not be less than nineteen nor more than twenty-four years of age, and before appointment must undergo a physical examination before a board of medical officers of the Navy, and must possess the physical qualifications required of naval cadets.

*Sec. 14. That the engineer cadets appointed in the Engineer Corps of the Navy shall be assigned to cruising ships for one year, and at the end of that year shall be ordered for one

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*Sec. 14 (S. 735).—That the engineer cadets appointed in the Engineer Corps of the Navy shall be assigned to cruising ships for one year, and at the end of that year shall be ordered for one year to the various working navy-yards or to such scientific post-graduate schools as may be established by the Secretary of the Navy, for such practical instruction as may be recommended by the director general of naval engineering, and approved by the Secretary of the Navy. At the conclusion of this two years' service they shall undergo a physical examination before a board of medical officers of the Navy, and a professional examination at the United States Naval Academy as now prescribed by regulation, and from those who pass, and in the order of merit as shown by that year to the various working navy-yards or to such scientific post-graduate schools as may be established by the Secretary of the Navy, for such practical instruction as may be recommended by the director-general of naval engineering and approved by the Secretary of the Navy. At the conclusion of this two years' service they shall undergo a physical examination before a board of medical officers of the Navy and a professional examination at the United States Naval Academy as now prescribed by regulation, and from those who pass, and in the order of merit as shown by that examination, shall be commissioned the engineer officers to fill the vacancies in the lowest grade of commissioned officers of the Engineer Corps of the Navy: *Provided,* That at least one-half of such vacancies shall be filled by graduates of the United States Naval Academy: *And provided further,* That after the number of commissioned officers allowed by this Act has been reached, the number of officers so commissioned in the lowest grade of the Engineer Corps shall be equal to the number of vacancies occurring in the Engineer

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examination, shall be commissioned the engineer officers to fill the vacancies in the lowest grade of commissioned officers of the Engineer Corps of the Navy: *Provided,* That at least one-half of such vacancies shall be filled by graduates of the United States Naval Academy: *And provided further,* That after the number of commissioned officers allowed by this Act has been reached, the number of officers so commissioned in the lowest grade of the Engineer Corps shall be equal to the number of vacancies occuring in the Engineer Corps of the Navy. Those engineer cadets who have successfully passed the examination but who do not receive commissions shall be honorably discharged from the naval service and shall receive one year's pay, as now provided by law. If the number of vacancies in any year is greater than the number of engineer cadets who have successfully passed the required examination, the surplus vacancies shall be filled from the successful engineer cadets of the following years, as they become available. The pay of engineer cadets shall be the same as that now provided by law for naval cadets, except that they shall receive the rate of pay known as "sea pay" during the time they are under instruction at the navy-yards and scientific post-graduate schools as above provided for.

Corps of the Navy. Those engineer cadets who have successfully passed the examination but who do not receive commissions shall be honorably discharged from the naval service and shall receive one year's pay, as now provided by law. If the number of vacancies in any year is greater than the number of engineer cadets who have successfully passed the required examination, the surplus vacancies shall be filled from the successful engineer cadets of the following years, as they become available.

Any enlisted man who has served three years in the Navy in the Engineers' Department, and who is not over twenty-five years of age, shall have an opportunity to compete with the engineer cadets for commission in the Engineer Corps of the Navy. He shall be commissioned as assistant engineer, if his order of merit at such examination shall entitle him to such commission.

The pay of engineer cadets shall be the same as that now provided by law for naval cadets, except that they shall receive the rate of pay known as "sea pay" during the time they are under instruction at the navy-yards and scientific post-graduate schools as above provided for.

That upon application to, and approved by, the Secretary of the Navy, an officer of the Engineer Corps shall be detailed to each technological school or college mentioned above, as professor of naval engineering, and that the number of officers now authorized by law for such purposes is hereby increased to permit such detail.

SEC. 15. That in order to promote the study of marine engineering as contemplated in the previous sections, the bureau of engineering is hereby empowered to loan, under conditions imposed by the Secretary of the Navy, to such scientific institutions as may establish the course of study herein provided for, and shall give the Navy a corps of trained men as a naval engineering reserve, such models, plans, and machinery as can be spared without detriment to the naval service.

*Sec. 16. That sections fourteen hundred and eighty-four and fourteen hundred and eighty-five of the Revised Statutes of the United States be amended so as to read as follows:

"Sec. 1484. Officers of the staff corps of the Navy graduated at the Naval Academy shall take precedence in their several corps and in their several grades, and shall take rank with officers of the line of the Navy, according to the dates borne by the diplomas or certificates awarded to them at the completion of the course of study at the Naval Academy before performing service afloat in other than practice ships, and according to their relative proficiency at such dates, as shown by the ratio which the merit mark obtained by each graduate bears to the maximum obtainable mark, and officers who have been lawfully advanced or lost numbers on the Navy Register shall be considered to have gained or lost rank accordingly."

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*Sec. 16 (S. 735).—That sections fourteen hundred and eighty-four and fourteen hundred and eighty-five of the Revised Statutes of the United States be amended so as to read as follows:

"Sec. 1484.—Officers of the staff corps of the Navy graduated at the Naval Academy shall take precedence in their several corps and in their several grades, and shall take rank with officers of the line of the Navy, according to the dates borne by the diplomas or certificates awarded to them at the completion of the course of study at the Naval Academy before performing service afloat in other than practice ships, and according to their relative proficiency at such dates, as shown by the ratio which the merit mark obtained by each graduate bears to the maximum obtainable mark, and officers who have been lawfully advanced or lost numbers on the Navy Register, shall be considered to have gained or lost rank accordingly.

"Sec. 1485.—The officers of the staff corps of the Navy not graduated at the Naval Academy shall take precedence in their several corps and in their respective grades, and with officers on the line with whom they have rank according to length of service in the Navy."

Sec. 17. That officers of the Corps of Naval Engineers shall not be entitled by virtue of their rank to command in the line or in other staff corps, except when assigned to such command or duty by competent authority.

Sec. 18. That every commissioned officer of the Engineer Corps of the Navy who shall have a regular or supervisory watch in the engine room shall be a ward-room officer.

Sec. 19. That the sum of seven hundred and fifty dollars is hereby appropriated to engrave a plate for printing the new commissions, which shall be furnished the officers of the Engineer Corps affected by this Act.

Sec. 20. That by reason of the scarcity of naval engineers all the naval cadets of the engineer division who have completed the course of study at the Naval Academy, and who are now performing duty at sea or elsewhere, shall be ordered to Annapolis at the earliest practicable day for the final examinations preliminary to promotion, and upon passing the several examinations satisfactorily, as required by the Academic Board, shall be commissioned by the President as ensigns of the corps.

Sec. 21. That for the purpose of providing a suitable place where engineering experiments may be carried on to the best advantage the naval station at New London, Connecticut, shall be placed in the charge of the chief of the bureau of engineering in the Department of the Navy, who shall, under the Secretary of the Navy, conduct such experiments and make such researches as may be necessary or expedient for the best interest of the naval service. That there shall also be established at this station, which shall be called the United States naval experiment station, a post-graduate course for engineer officers of the Navy and Revenue-Marine Service, under such rules as may be approved by the Secretary of the Navy.

That the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated, in addition to the regular appropriation now made for the naval station at New London, Connecticut, to carry into effect the provisions of this section.

*Sec. 22. That the pay of the officers of the Engineer Corps of the Navy shall be the same as that for the line, grade for grade: *Provided*, That the pay of a commodore on shore duty shall be four thousand five hundred dollars; on leave or waiting orders, three thousand six hundred dollars; that the pay of a captain on shore duty shall be four thousand dollars; on leave or waiting orders, three thousand three hundred dollars; that the pay of a commander shall be, at sea, four thousand dollars; on shore duty, three thousand five hundred dollars; on leave or waiting orders, three thousand dollars, and that the pay of no officer who served in the civil war shall be reduced by this Act.

Sec. 23. That all laws or parts thereof now in force inconsistent with the provisions of this Act are hereby repealed.

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*Sec. 22.—Senate Bill No. 735 omits a provision for pay, but it provides that the Engineers shall have the titles of the Line Corps; yet it appears that the Engineers, while seeking the titles, are not willing to accept the pay of the Line Corps. All the Junior Engineers are to be promoted and receive an increase of pay, but not so with the Line, according to this Bill. Everybody in the Engineer Corps is liberally cared for.

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RANK AND TITLE

IN

OUR NAVAL ORGANIZATION.

NECESSITY

FOR

THE ENACTMENT OF

BILL,

Senate 735—H. R. 3618.

INTRODUCED BY SENATOR Watson C SQUIRE, OF WASHINGTON,
AND REPRESENTATIVE FRANCIS H. WILSON,
OF NEW YORK.

OUR NAVAL SERVICE

SHOULD NOT HAVE AN ORGANIZATION FOUNDED UPON
THE NECESSITIES OF

WOODEN FRIGATES

IN AN

AGE OF STEEL.

Who Should Possess Rank and Titles

IN A

Naval Organization.

It is recognized by all who are students of naval affairs, that one of the most carefully drawn and far-reaching bills that has ever been presented concerning the *personnel* of the service is the measure presented by Senator Squire, of Washington, and developed by Representative Francis H. Wilson, of Brooklyn, New York.

Long before there was any prospect of our magnificent ships being required for early service, both Senator Squire and Representative Wilson had been carefully considering the needs of our naval service. A study of its organization convinced them that a radical change was necessary, and that a structure which was established in the days when there were only wooden ships was not adapted to the requirements of a service where the war vessels were made of steel. A naval service which regarded the engineer on board as an interloper and officially designated him as an idler was not abreast of the times, and in the hour of danger would prove a source of weakness rather than of strength.

NEW ORGANIZATION NECESSARY FOR NEW SHIPS.

These men were more concerned for the efficiency of the service, [illegible] the welfare of the Nation, than they were for th[illegible]imed vested rights of a special branch-of the navy. It was plain to them that on board the modern war ship were two classes of military specialists, the engineer and the artillerist. To the artillerist was given the honors and rewards of the service, although in importance he was not superior to his brother specialist, the engineer. The work of the latter was far more exhausting than that of the former, and the mortality in the Corps of Naval Engineers, during the past few years, proves that even in time of peace there is such an alarming number of breakdowns and prostrations, that the profession is a most hazardous one to life and to good health.

The records of the past conclusively prove that in case there should be a protracted war, we would undoubtedly require a greater number of engineers than deck officers. Those in charge of the navigation of the ship, and the care of the guns, could easily be replaced; while the supply of engineers is exceedingly limited, and the service could only be recruited, as far as this branch is concerned, by a progressive increase.

FEATURES OF THE NAVAL ENGINEERS' BILL.

The more carefully these bills are studied, the more impressed one is with their importance. They are pitched upon a higher plane than those bills which aim to secure the promotion of a favored few, and which seek to relieve the stagnation in advancement of the discontented. The engineers are struggling for principle, while the Line are fighting for promotion.

There are at least a dozen important features of the bill, and the greatest is undoubtedly, from an educational point of view, that section which seeks to encourage the one hundred scientific schools of the country to provide a naval engineering reserve for time of war.

Such authorities as Gen. Francis A. Walker, of the Institute of Technology, Dr. Robert H. Thurston, of Cornell, and Professor Hollis, of Harvard, regard the bill as the greatest educational measure of a technical nature that has ever been presented to any Congress. The Association of Land Grant College Presidents, as well as the ablest scientific educators of the country, are working earnestly and incessantly that this feature be incorporated into a law, and many strong appeals have been sent to Washington, urging the speedy enactment of this provision.

The section relating to giving the enlisted man an opportunity to secure a commission in the Engineer Corps, is in accordance with the principles of our country, and there are powerful influences at work which will not permit this feature to be eradicated.

The section which most concerns those who are already in the service, and which will have an important influence in determining whether the elect of our scientific colleges shall choose Naval Engineering as a profession, is the question concerning the status and rank of the engineer on board ship.

ENGINEERS MUST RECEIVE BETTER OFFICIAL RECOGNITION.

The passage of the Wilson-Squire bill is therefore vital to the efficiency of the modern steam navy in whatever way its usefulness may be regarded; either as to economy in respect to first cost and after maintenance of the vessel; absolute excellence of the vessels in design and execution; or judgment, technical skill, and zeal in the preservation and management of their complicated, costly and crowded machinery while in use. All these important points depend, and must necessarily always depend, on the intelligence, professional education, experience, knowledge and *character* of the members of the Corps of Naval Engineers. Perhaps the last qualification is fully as important as any of the others, and quite as difficult to obtain. It is the product of informed intellect, *esprit de corps*, and the pride and stimulus of prominent position; and it is worth more to the naval service than any price it may cost.

The importance of the duty of the Engineer Officer on board a naval vessel may be appreciated even by a layman, when the fact is understood that the Engineer Department may be composed of nearly one-half of the *personnel.* To them, and them alone, is implicitly confided, and always must be confided, the control of the motive and maneuvering power of the vessel. Can the importance of such officers in a naval service be over-estimated ?

THE PASSING OF THE SAILOR.

A modern warship is absolutely destitute of sails, so that when its machinery is at rest, the vessel lies an inert hulk on the water, powerless for offense, and almost totally so for defense.

The engineer *personnel* has thus absolutely superseded the seamen contingent so far as concerns the knowledge and practice of propelling the ship.

The sailor *personnel* has disappeared with the sails, and their real function is simply to use the artillery of the vessel and to perform those routine duties which require no special training of either officers or men. These routine duties consist of maintaining police order, keeping the bright work and hull clean, and supervising the petty details of life on board ship. The navigation of a modern vessel, whose motive power is steam alone, is not a difficult matter, and has been learned in a few weeks by an ordinarily educated lad. The special function of the Line personnel therefore on a modern battle-ship is the care, maintenance and operation of the artillery service, which includes the care of the torpedo. No special education is required for anything else in either officers or men. The modern vessel is a mass of complicated machines, whose efficiency therefore rests upon the ability and skill of the Naval Engineer.

SPECIALISTS ON A WAR VESSEL.

As regards specialties essential to the attainment of its objects as a war weapon or fighting machine, the battle-ship is divided into two distinct portions, namely, that of its artillery and that of its machinery; and, of these two, the machinery specialty is by far the more difficult to maintain, requiring a great deal the more experience and study; the most diversified and thorough information; the highest intelligence; and the greatest development of those personal qualities which are expressed in the single word "character." The physical endurance required from the engineer when embarked, is also much greater; the strain on his body and mind enormously exceeds that to which any other class of officers is subjected. In every military service except the Navy the engineer *personnel* has always been accorded a high place as regards appreciation of qualifications.

These remarks are not intended to detract anything from any other corps of officers, but it shows the true relative position of the Engineer Officers, and the part they actually perform and always must perform in a purely steaming vessel.

The functions of the Line Officers as artillerists and commanding officers, to whom also belong the navigation and policing of the vessel, are not sought to be belittled or invaded. What is hoped to be shown is that the functions of the Engineer Officers are equally as important as that of the Line, and that their rank, powers, pay, consideration, and acknowledged position should receive the consideration which they deserve. There is no desire to seek command of the ship, but of necessity the Engineer should control his own force, subject only to the authority of the commanding officer.

IMPORTANCE OF THE NAVAL ENGINEER.

The *real* position of the engineer must always make itself felt. This officer must be depended on to perform technical duties of the highest importance, for none other can perform them, and in order that the full worth of his services may be secured his position must be acknowledged and firmly secured by the definitions and enactments of law. In no other way can the highest kind of engineering talent required to supervise machinery costing hundreds of thousands of dollars be obtained.

The scientifically educated man, with thorough, practical, professional knowledge in a most difficult and important specialty and one demanding the best development of mind and body, will not submit to fill, and should not be asked to take, any invidious position, or to accept anything less than that to which his qualifications and the importance of his services entitle him. In these respects the efficiency of the naval service is more concerned than the Corps of Naval Engineers. The Congress should make such enactments as would secure for the naval service men of the highest efficiency, utterly regardless of the representations and wishes of any class of officers whose fancied interest and prestige might thereby be lessened.

THE LINE MERELY A PART OF THE NAVY.

The Line Officers of the Navy are not the Navy, although some contemptuously say, "the Engineers are of the Navy but they are not naval officers." The only man who can understand the distinction is one who is a slave to his prejudices. Like the surgeon, paymaster and engineer, the Line Officer is a part of the Navy, and as Secretary Herbert forcibly expresses the truth, no branch of the service has a claim to vested privileges.

The war vessels of a country with their crews, as a whole, constitute the Navy, and the efficiency of these vessels *as a whole* is the sole consideration that should govern. A fault in either the design or the execution of any part of the vessels, including machinery, is just as fatal to success as incompetency in their *personnel.* Incompetency in the engineering department of a war vessel will be just as disastrous as inefficiency in handling the battery.

The coddling of one set of officers, as regards pay, rank, title, position, power, privileges, etc., to the neglect of other officers whose duties are just as important, is a certain way of securing inferior talent and character. It invites defeat in the issue of battle, for which alone navies exist. The good of the Commonwealth should be the sole consideration, against which naval traditions, usages, jealousies and the desire to obtain all the advantages, prestige and emoluments of the naval service, should be urged in vain. This favoritism can only be secured by a corresponding injury to the Navy as a National weapon.

The fact should be fully realized that the modern steam navy is a totally different navy from that of the previous century, the latter bearing to the former about the same relation that the old turnpike with its stage coach bears to the railroad with its locomotive-dragged train. The *materiel* has changed, but there has not been a corresponding change in the *personnel*. In consequence, the new apparatus is very clumsily and inefficiently managed by an obsolete system of organization, which attempts to adapt modern appliances to practices which were only suitable to antiquated machines.

PRESENT NAVAL ORGANIZATION NEEDS IMPROVEMENT.

The present naval organization, by reason of not permitting the full measure of the Engineer to be utilized, is distinctly behind the age, and if ever put to the crucial test of actual warfare with a capable foe will show the truth of these remarks. The old system is unadapted to the new conditions, and a fundamental revision must be had to bring the two into harmonious relation. In no other way can we secure from the engineer the highest possible result which he is capable of giving. It is essential to the Nation's military power that the traditions of a previous century should not stand in the way of his usefulness and efficiency. It is, therefore, reiterated that the country is more interested than the Engineer Corps in making a proper change, and that justice to the engineer will bring substantial benefit to the deck officer, and glory and renown to the commander.

The opponents of the provisions of the Squire or Wilson bills have never advanced a single argument against them. Statements and denunciations have been made with clamor, and the untruth that the engineer desires to command the ships is advanced. This falsehood has always been disclaimed by the engineers, and every bill which has been presented in their behalf takes cognizance of the supreme authority of the commander of the vessel. There is a protest, however, against a dozen commanders with conflicting views giving orders to the Chief Engineer as to how the machinery shall be maintained in an efficient condition.

The case attempted to be made against the engineers is singularly marked by absence alike of fact and reasoning, and by a complete ignoring of the changed conditions of the naval service.

CHANGE IN THE MANNER OF PROPULSION.

The question is now simply one of the locomotion of the vessel. Formerly it was affected by persons trained in one specialty; now it is affected by persons trained in another and wholly different specialty. The manner of propulsion is now much more complex and requires vastly greater attainments. When it is said that the qualifications of the engineers are inferior to those of the sailor, would any well-informed person seriously maintain such an opinion?

Again, ordnance compared with engineering is a very simple specialty; the gun is quite an elementary machine compared with the marine steam engine. The factor of safety which is employed in building up the several parts is very large, and only gross carelessness upon the part of the inefficient can disable the mechanism of a modern rifle.

The management of the internal economy of vessels and their police administration do not constitute a specialty. They are perfectly practiced by the average steamboat master of even a river craft, and this power of command can be acquired by any person gifted with ordinary common sense and executive ability. Neither special training nor long experience is required to attain these qualities, for in the world's history there have been great military leaders who have been almost youths.

HIGH-SPEED VESSELS MUST HAVE LARGE ENGINE-ROOM COMPLEMENTS.

Why should not the Engineer Officers, who necessarily must personally command a large fraction of the crew of a naval vessel, whenever that vessel is not at anchor, and who have to supervise this force in the adjusting and repairing necessary to maintain the machinery in its best condition, be given the authority which is vested in the man on deck? On board the *St. Paul* and the *St. Louis* two hundred and ten of the four hundred men comprising the crew are in the engineer's department. Of the two hundred men who do not work in the stoke-hold or around the machinery, two-thirds are in the steward's department, so that on the ocean greyhound not over a sixth of the force comes within the immediate direction of the deck officer. The engineers, therefore, must supervise the work of three times as many men as the officer on the deck, and yet there is a paradox of asserting that the engineer is not a military officer and, therefore, should not have any rank, and should be deprived of the authority which should be absolutely given him, subject alone to the will of the commander of the vessel. Upon the character, professional ability and readiness of resource of the engineer depends the efficiency of the complicated mechanism of the vessel. On board the commerce-destroyers *Columbia* and ***Minneapolis*** the value of the machinery is more than one-half the value of the entire ship.

VALUE OF ENGINEERING SKILL AND TALENT.

The entire military value of the vessel may be said to depend upon the skill of the men in the engine-room, for with the machinery inoperative the vessel can merely drift helplessly like a raft wherever wind and wave send it. Upon the engineer also is confided, not only the care of the machinery as regards keeping it in moving order, but the maintaining of it in such a condition that it can at any moment be worked with possible maximum power, for on that increased power may depend the difference between victory and defeat; may depend the difference between the successful performance of an important duty and of a failure fraught with national ill consequences. The difference of one one-half mile per hour in the vessel's speed may mean all that and more, and this difference may be easily due to difference of efficiency in the machinery, due in its turn to the skill, zeal and energy of the scientific engineer controlling it. Why, then, should not that officer, who controls the motive power, be given the position of absolute military rank in a military service, also the title of that rank which would enable him to command the engineer's force of the vessel with promptness and efficiency in the line of its own peculiar specialty? He would thus receive from his subordinates the respect and instant obedience only possible when he is thus possessed of the undisputed right of military rank in his own department.

NECESSITY FOR TITLES.

The title of the rank is as necessary as the rank itself, for without the title, how can rank be known or made effective? Is anything more absurd than to give the rank of title to an officer, for example, and yet enact that he is never to be called captain. To what purpose, then, is the rank of captain? "Captain" is simply the name of that rank, and it cannot be denoted by any other name. How is rank to be discriminated but by its name?

To be of any use to the holder or to the Navy the rank must be known by its name, otherwise it will be inoperative, and the purpose of Congress in giving it will be defeated. What would be thought of naming a person John with the proviso that he is never to be called John? This homely comparison shows the true state of the case, and can be understood by all.

When, for example, the title "Captain" is applied, all know what the rank and position of that officer in the Navy is, and such is the purpose of the title. If, however, it is not applied, but some other and utterly incongruous title is adopted, like "Passed Assistant Engineer with the relative rank of Lieutenant of the Junior Grade," it brings the title and holder into ridicule. There is nothing in such a title to indicate the rank and relative position of the officer to other officers whether of the Line or Staff. Wherein can a valid objection be urged to calling this officer "Lieutenant" of the Engineer Corps?

The great object of rank is to indicate exactly a man's official position in a military service. The same rank should bear the same title for all; for official purposes the name of the Corps of the service to which the officer belongs should be added, in exactly the same manner as is now done, and always has been done, in the Marine Corps. The officers of this service bear appropriate official names, and they have ever been proud to specify that they belong to the Marine Corps.

If every naval service in the world considers it entirely proper to designate Captain Cartridge of the Marine Corps as an official title, why is it considered wholly inadmissible to object to Captain Power of the Engineer Corps having the same title? The withholding of the appropriate title of the rank of an Engineer Officer is a deliberate belittlement of him and of his position, and tends to greatly reduce his value to the Government in addition to the infliction of an official wrong.

STAFF OFFICERS ARE NOT SEEKING COMMAND OF VESSELS.

No Staff Officer desires or hopes to command a vessel. This is not his purpose in asking for unqualified rank and titles. The possession of rank, be it great or small, does not entitle the bearer to either military command or any other kind of command. The right to command is not general but specific. It exists only by the direct order of the Navy Department personally addressed. No admiral can exercise the slightest command unless by the particular orders of the Department. Neither his rank nor his title, in the absence of specific orders, entitle him to command anything. No officer of less rank, nor any enlisted man, is obliged to accord him the slightest obedience. His rank indicates where he stands, *when on duty*, in relative position to other officers who have been *ordered by the Navy Department* to serve on duty with him. His title simply designates his rank. In fact it is the conventional name of his rank, and that is all there is of it for him or for others. *It is not a patent of nobility nor a license for privilege.*

There can be no efficient naval organization without the distribution of all its officers into ranks. Without this rank every naval officer, no matter to what corps of the organization he may belong, has an officially discredited position. It is essential to the efficiency of the Staff Officer as to his brother officer of the Line.

Except the title of his rank be given him, his proper position, compared with others, cannot be indicated or referred to. In no other way could he know who was above, who was below him, or what were his rights, powers, responsibilities or duties.

SELFISH POLICY OF THE LINE OFFICERS.

It is very natural that a particular branch of the Navy, which under the old régime of purely sailing ships was the only branch, was indeed the Navy, should be tenacious of that position. They will always desire to be considered the only branch of the service, assuming other corps to be simply adjuncts to itself. The Line Officer desires still to appear as performing the entire duties of the Navy, though a very important portion of those duties have passed irrevocably from his hands. The locomotion of the vessels, that was the pride and specialty of the old Navy, a Navy which in fact is now a departed Navy, has become a distinct specialty, requiring the study and practice of a lifetime upon the part of the engineer. This new profession combines in itself, to a very remarkable degree, the most advanced physical and mathematical sciences with the highest development of mechanical art. Such is a true description of engineering at the present day. The conditions have utterly changed since the time of sailing ships, or even when steam was an auxiliary power.

The exclusive position of the line branch is no longer tenable. The good of the Navy itself, the good of the Commonwealth, the progress of the world outside of naval affairs, all render such a system most undesirable. The Navy, to retain its usefulness, and to increase its efficiency, must change with the changed conditions and advance with the progress of the age. By reason of its being wedded to the traditions of the past, as well as by possessing an organization which is patterned after the requirement of mediæval ages, the service is now belated, fossilized, and needs a fundamental reorganization to resurrect it into vitality.

BITTERNESS OF LINE TOWARD THE STAFF.

The resistance to change made by those who imagine they have a vested interest in what has really passed away, and who consider themselves as possessing a proprietary right in the Navy, is unreasonable and unreasoning. It is made with passion and misrepresentation proportional to its want of argument and fact. It is made without judgment as without generosity, and surely cannot convince any person of common sense who disinterestedly examines the case.

Needed reforms will never be voluntarily made by the Navy itself. They must be imposed by external force, and Congress should firmly initiate them without regard to the protestations and unjust assertions of those who cling to an effete system. The line officers tenaciously hold to an antiquated organization, not because such an organization is sustained by them, but because they are enriched and sustained by it.

The line officer poses as the only military officer in the Navy, and to sustain this position he seeks to appropriate the rewards of the important work done by others. He attempts to deny all appreciation and recognition to officers of other naval corps, and attempts to usurp privileges and honors which belong to those who have won them.

This same insensate opposition was made to giving the officers of the Staff Corps what is called "relative rank." In times past the line officer objected to a staff officer wearing a uniform; in fact, he opposed giving him any official recognition at all.

LINE JEALOUS OF THE ENGINEER.

The same protestations and assertions, with the only inspiration of self-interest, were made against the advances of the Staff in the past, and they are now made against giving the Staff absolute rank and eliminating the word "relative," which has been productive of so much trouble and contention in the service.

The previous advances made by the Engineers and other Staff Officers against the solid opposition of the Line Officers are now known to have been highly beneficial to the Navy and to the country. Even the Line Officers would not recall the privileges granted in past years, for they realize that the ships have been made more efficient by strengthening the officers of the Staff Corps.

To complete the reformation and to provide for a harmonious service, there only remains to be enacted the provisions of Senator Squire's and Representative Francis A. Wilson's developed bill. When that is done, the Navy will have become specialized, as it should be and must be if efficiency is to be secured. The more independently it is specialized, and the sooner that result is brought about, the better it will be for the naval service.

The intolerable assumption of persons, who do not know, to domineer scientific and administrative specialists who do know is fraught with great evil and must soon be ended if the interests of the Navy are to be subserved. Under the authority of one commanding officer must the engineer work, and not under the conflicting orders of several people who claim to be the personal representatives of the man in command.

INJUSTICE OF GIVING ENGINEERS DISCREDITED TITLES.

By giving the engineer all the prerogatives of his rank there would be real discipline maintained instead of the present unsatisfactory system, which is merely nominal discipline. The present naval organization invites dissension, and there is a constant conflict between the officers of the Line and the Staff, the parallel of which is not seen in the Army. By giving positive ranks and titles there would be efficient action on the part of all, whereas no such action is possible now, except by the rare concurrence of persons of exceptional qualities on both sides, who tacitly agree to ignore absurd regulations, and to act on the basis of common sense and self-evident propriety.

Under the present system the Navy exists for the sole benefit of the Line Officers. Should it continue to do so, or has the Commonwealth some interest in this matter? The answer to this question is contained in the provisions of the bills introduced by Senator Squire and Representative Wilson.

The patriotic and important provisions which are contained in these measures will be nugatory unless the Engineer Officers are given positive rank and all the prerogatives which such rank should confer. The title should in reason, custom and propriety accompany the rank when it is given by the Congress, and the only people in the country who object to such action are the few Line Officers of the Navy. The Line of the Army make no claim that the possession of titles by the Staff is derogatory to the interests of the military establishment.

SENATOR EDMUNDS' VIEW OF THIS MATTER.

Such a great constitutional lawyer as Senator Edmunds maintains that the law as it now stands gives to the Staff a legal claim to such titles, and that neither in equity or in law have the Line Officers a right to hold them alone. The Line tacitly and inferentially acknowledges this fact by seeking in bills, now before Congress, to give the Engineer Officers titles having no connection with rank. They desire everybody but themselves to have professional titles. The officers of the Line now admit that for years a great wrong has been done the Staff, for, in some of the bills inspired by this branch of the service, the word "relative" is omitted, and something is given which they will admit is not positive, but is slightly better than the existing status.

As a matter of common sense and extended experience, a rank that does not carry its title with it, is practically no rank at all. The history of the past upon this point shows the absolute necessity of giving the title as well as the rank *specifically by law.* Nothing must be left to inference, for the inference in the future, as in the past, will be that which the fancied interests of the Line Officers require. Ever since the organization of the Navy they have controlled the judicial decisions of the Department, and the Staff Officers can only secure justice by specific laws.

TITLES MUST ACCOMPANY RANK.

If the titles of the rank be not made obligatory by law, an important feature of the Wilson-Squire bill will be defeated, and its intended effect nullified. There can be no concession, modification or compromise in this respect. The title of the rank is absolutely essential to the efficiency of the rank, for the officer possessing such rank must be known to have it authoritatively. This title, which is already sustained by public opinion, must be conferred by the Congress and officially recognized by the Navy Department. One possessing rank must be able to claim all that goes with it, such as official consideration, responsibility, power, prestige and position. The Engineering Bill is intended to give these, and the attempt to deprive it of the single provision which makes him an integral part of the Naval service, would be to absolutely emasculate an important section.

The titles of the ranks are simply the names of the ranks and are nothing more. They are not the professional titles of one corps of the Navy more than any other corps. There is nothing professional in them. The really professional titles of Line Officers are, as all the world knows, Masters and Mates. These titles belong exclusively to them, and they should be proud to be so designated; but the Line Officers, who are so desirous of bestowing professional titles upon others, do not show the same alacrity in accepting for themselves what are undoubtedly their own professional property. They ask that special consideration be given the "man behind the gun." Why should not the same honor be awarded the engineer, who is "the man behind the ram"? It is considered right to give the one a title, but an outrage to bestow it upon the other.

LINE OFFICERS DISOWN THEIR OWN PROFESSIONAL TITLES.

That the above statements are quite correct will be understood from the fact that during the Civil War the Line Officers taken into the Navy by the hundreds from the Merchant Marine, and there officially designated as Mates and Masters, were given titles in the regular Navy. Upon their return to the Mercantile

Marine after the close of the war, they resumed their professional titles of Masters and Mates. During their service in the war they bore the proper title whatever was their rank. Such action was logical, necessary and correct, but their rank titles were not professional ones, and did not designate their exact duties, but only the relative position of the person in the naval service. There are to-day on board the flagship *New York*, three men who are officially designated as Captain, the Captain commanding the ship, the Commander who is Chief of Staff, and the Captain commanding the Marine Guard. Nothing has been heard of a conflict of authority between these men by reason of all possessing the same title which has been given them by law or regulation.

To pretend that the titles of Admiral, Captain, Commodore, Lieutenant, etc., indicate, *sui generis*, the profession or duties of Line Officers is false and misleading. There are officers of other corps whose duties require an exactly similar arrangement of rank and title; so that their position with others in the military and naval service may be absolutely established. The officers of the Staff Corps should have therefore the same title or name of rank, their official address, however, being that title with the addition of the name of their corps. Such an arrangement would show at once where each officer stands relatively to all other officers in the service. It is the only way in which they can be known officially as officers at all either in practical life or when on duty.

INJUSTICE TO STAFF IMPAIRING EFFICIENCY OF THE NAVY.

The most important point as regards the *true* discipline and efficiency of the naval service, is the assignment by act of Congress to every officer of a distinct rank. The intention of such an act must not be distorted, misrepresented, nullified, nor its application avoided ; and, therefore, the officers of the Staff unqualifiedly ask for proper titles in order that their position may be absolutely established.

This question will never be satisfactorily settled until it is settled right ; and, therefore, the same rank should bear the same title for all, the name of the corps to which the officer belongs being added. The lack of this simple and indisputable method will always be the cause of confusion, weakness, dissatisfaction and inefficiency, and will inevitably produce disastrous consequences both in peace and war. The objections to it are futile to the last degree and are based on the reluctance which one class of officers who have long been in exclusive control of the Navy naturally have to share any portion of their prestige with officers of other corps.

THE AGE OF STEEL AND NOT OF SAIL.

The existing condition of affairs in the naval service becomes more and more diverse from those of former days, due to the amazing strides made by modern science and continual industrial improvement. It is imperatively demanded that the organization make a corresponding change and that the position and importance of the engineer be officially recognized. What is sought by the Staff does not deprive the Line of any portion of their command, but would really enable them to command with greater success, promptness and efficiency. There will always be trouble where persons ignorant of difficult and important specialties undertake to direct them instead of heeding the suggestion of the responsible heads who are professional experts. During the past two months, by reason of the favor which the Squire and Wilson bills have been received throughout the country, the opposition to conferring rank has almost vanished, but this opposition has been directed to preventing the engineer Corps from securing a proper title. The engineers will be content with nothing but what is their just due. They comprehend the fact that the rank cannot be made to perform its duties properly unless it is officially acknowledged, and this can only be accomplished by giving it by law its correct name.

THE NAVAL ENGINEER A MOST IMPORTANT COMBATANT.

To accord rank and then to deny the title of the rank is inconsistent, and it is advocated only by those who wish and intend, if possible, to nullify the rank itself. If rank is given without military title, the question will not be settled, but will make its appearance with every succeeding Congress until the Staff Officer secures what belongs to him. By continuing this contention, the public service will be greatly injured, and nothing will be accomplished.

The great development which naval warfare has received during the last quarter of a century—and the process is still extending—has brought into existence new specialties and intensified old ones until no person can be proficient in all of them.

> " One science only will one genius fit,
> So vast is art, so narrow human wit."

The claim of the Line Officer, to know sufficient of all of these professions to enable him to assume their direction and control, is simply preposterous. On board a vessel the efficiency of each department or specialty must have its own head who must have appropriate rank and title, and he must be individually responsible only to the commanding officer and the Navy Department.

The knowledge of ordnance with all its ramifications is itself a vast specialty, and when to this is added the command of the vessels, there will clearly be seen that the Line Officers will have full employment for their time and capacity, without interference with other important specialties of which they know very little.

ORDNANCE BUT NOT THE ENGINEER SPECIALIST GIVEN RANK.

It now looks as if a great improvement will be introduced into the naval service by the addition of another specialty—that of ordnance. There should be a select corps of such officers, educated as highly as possible in this branch, and one or two of them should be embarked in each vessel to serve entirely as artillerists. In their hands would be placed the management and care of the guns and the small arms of the vessel. This would be in the line of real efficiency, and will eventually have to be done; but would such officer be denied the rank and title that would enable him to perform his duties properly and authoritatively? If this specialist can be given rank and title with propriety, why is it denied the engineer? It is a mystery which can only be solved by those who are determined not to surrender any prerogative or right, whether or not the efficiency of the service is sacrificed thereby.

ENGINEER SPECIALIST MORE ESSENTIAL THAN THE ORDNANCE SPECIALIST.

Should not the Engineer Officers, to whom must be intrusted the supervision and management of so important a part of a naval vessel as its vast and complicated machinery, of which both theoretical and practical knowledge is necessary, embracing nearly the whole of physical art and science, who have actually to command, as long as the vessel is in motion, over one-third of the crew, and who, when the vessel is at anchor, need and must have the services of nearly one-third the crew in the adjustment, repairs and maintenance of the machinery in condition for maximum effect at a moment's notice, be given the rank in accordance with the pay and prestige of their position? Why should they not be given the titles of that rank in order that they may be enabled to perform their duties authoritatively, for they cannot otherwise give the full measure of their service to the Nation unless their official status is beyond criticism.

Under the present system, the Engineer Officers maintain discipline and efficiency in their department by tact, force of character, and superior intelligence, combined with the good common sense of the *personnel* under them, but without the support which they should have of the recognition of their rank. It is essential that the Congress of the United States and the Navy Department give to the engineers such rank and title as will enable them to perform these duties with maximum efficiency.

EDUCATIONAL FEATURE OF ENGINEERS' BILL OF NATIONAL IMPORT.

The bills introduced by Senator Squire and Representative Wilson are of a dual nature. The educational features which are comprised in both these measures will bring to their support the powerful influence of over one hundred technological schools throughout the country. The elect of these institutions desire to connect themselves with the naval service, but they will not seek these commissions until they are assured that positive rank and titles are accorded the officers of the Engineer Corps. They will not enter a service or a profession in which their work is to be discredited, and where they will be subjected to continual annoyance.

In order that this great educational measure may be of substantial worth to the Nation it must be shown to the technological institutions of our land that a new order of things has been established, and that the prejudice and the injustice which has been done the engineer in the past will not be permitted to continue longer.

8

BILL,

Senate 735–H. R. 3618,

INTRODUCED BY

Watson C.

SENATOR SQUIRE, OF WASHINGTON,

AND DEVELOPED BY

HON. FRANCIS H. WILSON, OF BROOKLYN, NEW YORK.

ANALYSIS BY

IRA N. HOLLIS, *Professor of Engineering, Harvard University, Formerly Passed Assistant Engineer U. S. Navy.*

IENCY AND PATRIOTISM,

NOT

judice and Tradition,

SHOULD BE

GUIDING PRINCIPLES

IN

ORGANIZING THE PERSONNEL

OF THE

U. S. NAVY.

The Reorganization of the Engineer Corps of the Navy.

By Ira N. Hollis, *Professor of Engineering, Harvard University, Formerly Passed Assistant Engineer U. S. Navy.*

(*From The Railroad Gazette, February 7 and February* 14, 1896.)

The engineers of this country cannot fail to take a deep interest in the bill now before Congress to increase the usefulness and numbers of the Corps of Naval Engineers, to aid technical schools, and to establish an experimental station where many of the problems of interest to builders all over the country may be investigated. It is directly in line with a fuller recognition of engineering as a profession worthy of the respect and rewards due from a great nation whose material prosperity and industrial growth have been made possible by the engineer.

Our country is cemented together by the vast railroad system which is directly the work of engineers, and our maritime growth will depend largely upon the skill of engineers, whether those engineers are called marine engineers, engine drivers or naval architects. The recognition has been given cordially in the Army, while it has been withheld for many years in the Navy, probably because the naval organization, which is largely a survival from the days of sailing vessels, is not elastic, and does not suit itself readily to modern conditions.

The bill as presented to the Senate by Senator Squire, of Washington, and to the House by Representative Francis H. Wilson, of Brooklyn, N. Y., contains a number of features well worthy of the consideration of Congress. As men in civil life do not usually understand naval methods and organization, it may be well to consider the most important items of the bill, and to explain them somewhat fully.

THE FIRST PART OF THE MEASURE FIXES THE NUMBER OF COMMISSIONED ENGINEERS IN THE NAVY AT 303,

an increase of 110 over the number actually allowed by law. This increase is in accordance with the recommendation of the Engineer-in-Chief, who has stated in several annual reports that the number of engineers is now insufficient for the duties to be performed on shore and on board ship, and that the property of the Government is suffering for want of sufficient care and attention.

He has called the attention of Congress also to the fact that matters will be much worse in the near future when the new ships, now building, are completed and commissioned. The number of engineers in the Navy at the end of the war was 474, and in 1880 the number had dropped down to 250, the allowance by law being 270. It will be seen, therefore, that this bill simply restores the number to somewhat the same proportions it bore when we had a navy of wood with auxiliary steam power.

The duties performed on shore by the engineer consist of the design and inspection of the propelling machinery and boilers, and of certain auxiliary machines for all our ships; of the care of navy yard machinery under the control of the Bureau of Steam Engineering, and the inspection of boilers; of the superintendence and inspection of all repairs to machinery; of all the routine duties incident to examination of men for employment or enlistment in the engine departments, and to the examination of officers for promotion, and of the inspection of certain materials for use in the naval service.

The duties of the engineer at sea consist of the care of propelling machinery and of most of the auxiliary machinery; of the repairs to all machinery; of keeping watches in all except the smaller vessels, and superintending the running of machinery; of looking after the storage and expenditure of coal and stores; of keeping that part of the double bottom and inner skin of the ship beneath the machinery and boilers properly cleaned and painted; of looking after the efficiency of all pumps; of keeping in good condition all water-tight doors in the machinery and boiler compartments; of making all official reports and requisitions under the cognizance of the Bureau of Steam Engineering; of maintaining a division of from 20 to 196 men in a state of organization and efficiency, the number of men depending upon the size of the ship; also of requiring and inspecting the clothing for these men; and of other duties, such as court-martial, official inspections, ship visiting and examination of provisions and stores, which all officers, line and staff alike, have to share.

Men outside of the Navy who see the new ships and read about their performances constantly express astonishment that the enormous increase of machinery should actually be accompanied by a decrease in the number of engineers, and it is a puzzle even to the naval engineer to find his services rated less, while greater responsibilities are being placed on his shoulders. As this paradox is the result of great changes within a comparatively short period, both of materials and of the nature of the responsibilities thrown on the officers of the service, it is deserving of extended consideration.

Among the advances most important to the human race have been those connected with transportation, both on sea and land. Marine machinery is now fast replacing sails, and the day is near at hand when it will not pay in the merchant service to run a sailing vessel. A man who to-day should design a fast mail steamer with great sail power would be considered a lunatic. The Navy, also, has changed, sometimes leading in the march of improvement, sometimes lagging behind.

Our war-ships have practically abandoned sails. Not even an officer of the old sailing Navy would dream of putting sails on a battle-ship. The latest vessels, such as the New York, Columbia and Indiana, have not a stitch of canvas, unless it be a few awnings or wind-sails. They are machines from stem to stern, which depend for their efficiency in times both of peace and war upon the force of mechanics and firemen placed on board.

These ships cannot keep the sea for long periods without coaling and repair stations within easy reach of each other, unless they are accompanied by colliers and carry with them a large force of engineers and mechanics, and great numbers of spare parts. For maintenance in an effective cruising condition they are largely dependent upon the energy and zeal of their engineers, and in case of accident to machinery or boilers they are absolutely dependent upon their engineers.

The change to these conditions has come about with startling suddenness. Forty years ago ships were rigged with full sail power, and barely enough auxiliary power to clear the land and to begin the cruise under sail alone. At the outbreak of the war some of our cruisers had no machinery at all. All of the officers of the line down to the commander's list entered the Navy under these conditions, and most of the officers, down even through part of the lieutenant's list, began their naval life on ships with little or no steam power. The consequence is that now we have a number of men shaping our naval policy and commanding our war-ships whose traditions and beliefs belong to the past, men who cannot, by the very nature of the changes, adjust themselves to modern requirements.

Even the engineer corps itself has suffered in the upper grades from the lack of experience with the new machinery. Many of the commanding officers and some of the chief engineers have hardly had time to serve on a new cruiser, and not half a dozen of them have had duty on a modern battle-ship. It is no discredit to the men who command our ships and who would, without doubt, fight gallantly for the flag in time of need, that they have not yet adjusted themselves to their new surroundings. It is only a pity, for the sake of the efficiency of the Navy, that they have arrayed themselves against every change that does not recognize and make more secure their own positions as the only part of the service which deserves consideration.

While our older officers have been going to sea or marking time in navy yards, and our younger men have been imbibing their traditions, the technical schools and universities have turned engineering into a profession whose claims are second to none in our country, and vast manufacturing establishments and railroads have grown up under the hand and eye of the engineer, whose progress has been watched and applauded on shore by people unfettered by traditions of a past.

Every effort of the Engineer-in-Chief to bring the numbers up to modern necessities has been thwarted, in part by men who are conscientious in the belief that our service will go to the dogs if the engineer gets a firmer grip; in part, by men who care nothing about the good of the service so long as the interest of a class is served.

The only argument produced against the increase of numbers worth listening to for a moment, is that scientific men are not needed to run our engines, and this argument does not bear examination. The statement made by line officers to the Secretary of the Navy, to Congress and to the public is that we do not need so many high-class men in the engine-rooms and fire-rooms; that what we really want on the cruisers and battle-ships is one, or perhaps two, educated engineers, and a number of machinists. Along with this argument goes the assumption that the deck officer, who has charge of a gun, must be highly trained in science and exceptionally well versed in international law.

When we stop to think that the New York, which is a flagship, contains sixteen of such men, and that the Yorktown, which is one of our smallest ships, contains eight, we realize what a preposterous conclusion has been reached here. The writer has no disposition to lower the status or educational qualifications of the officers of the line; on the contrary, he believes that education and intelligence are the only guarantees of a really efficient personnel, whether it be above decks or below.

So far as the absolute working of the guns, the passing of powder or the starting of a steam engine is concerned, they involve the same grade of intelligence and may be classed among the manual arts which most men can learn by a moderate amount of practice; but these functions form a very small part of the duties of officers on board ship, either of the line or of the engineer corps.

If the first lieutenant of a ship has to organize and discipline the crew to stay at the guns and to work them in action, the chief engineer has a much more difficult task in organizing and disciplining a division of machinists, oilers, firemen and coal-heavers to remain below decks shut up in water-tight compartments and to run the machinery and boilers under a nervous tension hardly understood by men on deck, or in the turrets.

In time of action the engineers' division would be scattered through half a dozen or more water-tight compartments completely cut off from one another, while the chief engineer would probably be in one of the engine-rooms dependent for his control of the men upon the uncertain communication of speaking tubes or of telephones. Can any one doubt that this control would be far more effective with an intelligent commissioned officer in every principal compartment?

The word commissioned is used here because it takes education and a commission to hold a man up to the very highest sense of responsibility amid such surroundings. The captain of a ship would feel helpless without an officer in every turret, with every heavy gun, with every group of small guns and with the powder division. Only a lack of appreciation of the duties below could bring him to believe that less responsibility attaches to the duties in the water-tight compartments.

We have heard a great deal about the man behind the gun; as a matter of fact, the fireman who brings the gun into action and carries it out again is just as much behind the gun as the powder boy, or the man who pulls the lock-string. If a distinction is to be made, the fireman might be called the man behind the ram, an instrument that may play a far more important part in warfare than the gun or torpedo.

Besides the organization of the engineers' division, the chief engineer and his assistants have no light task in keeping the machinery and boilers always ready for use; a repair shop must be kept running on board ship all the time. Still further, every ounce of coal must be used with the utmost economy.

With the exception of the Columbia and Minneapolis, hardly a ship in the Navy could keep the sea a month without re-coaling, and every pound of coal saved would go to increase the endurance and effectiveness of a warship. Neither the price of coal nor the salaries paid to the officers should cut any figure in the matter. It is solely a case of bringing greater intelligence into the engine-room that a ship may keep the sea longer.

So far, from lack of officers, the Bureau of Steam Engineering has done practically nothing in the study of the use of coal on board ship. We know that feed pumps use a great deal of steam, that dynamo engines are exceedingly wasteful, but just how the steam or coal is distributed among the different engines, nobody knows. The Government would probably save thousands of dollars by sending enough officers with our machinery afloat to make a thorough study of this question. In this the Engineer-in-Chief is helplessly bound by Navy regulations and lack of men.

There are in the whole engineer corps of the Navy, 173 officers against 146 in the line who have attained command rank. Yet we have a proposition from the Secretary of the Navy to increase the number of commanding officers in order to afford adequate promotion and rewards for officers of the line.

If one is to judge by his annual reports, the Secretary has no realizing sense of the significance of the struggle that is now going on between the corps of the Navy, and this brings out another difficulty in dealing with the engineer question.

For many years our Secretaries of the Navy have been lawyers, with little knowledge of maritime or military affairs, and with absolute ignorance of shipbuilding and marine engineering; this, too, at a time of transition when our Navy is rapidly becoming an aggregate of huge machines.

A man who accepts the office of Secretary without experience and judgment in the business he is going to undertake should, therefore, invite experienced men into his councils and should depend largely, if not wholly, upon their opinions. If he is a strong man he will have sense enough to discriminate intelligently and to judge properly the characters of his subordinates; but if he is a weak man, of poor judgment, he will quickly fall into the hands of the men whom he sees oftenest in the Department or in the society of Washington, and who are the most plausible and glib of speech.

There has been a tendency of late years to surround the Secretary as much as possible with officers of the line, and to make the line the sole channel of communication between the staff corps and the Secretary. This has not yet been entirely accomplished, but so nearly so that the Secretary is in great danger of becoming the mouthpiece of a class, or rather of a group of officers selected from a class, with small experience at sea, but with large experience in adapting themselves to the forces which govern Washington society, and, to some extent, the Congress of the United States. It is small wonder, then, that the present Secretary is committed wholly to legislation for the line; the wonder is that he did not recommend the abolition of the staff.

A third element in this struggle against the engineer is the feeling with many officers of the line that engineers have to deal with oil, steam, coal and iron; that they often get dirty on duty, and therefore have somehow not the same claims to recognition as officers. Fortunately for the good of our service and for the happiness of the officers who have to live together on board ship, the Naval Academy is dispelling this illusion.

No fair-minded man whose classmates are engineers and have the same claim as himself to respect for their attainments and cultivation, can cherish this idea. To the public it makes little difference whether a man's face and hands are blacked with coal dust or with powder so long as the honor of the flag is maintained.

The proposition of the line for the improvement of the Engineer Corps may be summed up very briefly, as follows: To send very few engineers to our ships, and to replace them wherever possible by machinists, whose pay they have fixed at from $40 to $70 a month, and to obtain at the same time the same sense of responsibility and the same interest and intelligence in keeping up the efficiency of our machinery.

It may be added that a further plan contemplates making these machinists warrant officers in case they display the proper amount of subordination and zeal.

Under such circumstances one could not blame the engineers for extravagance in their demands, but they have been singularly moderate in the request for increase of numbers; as before stated, Congress is simply asked to do a little more than restore the numbers of sixteen years ago.

This brings us to the second point in the bill:

TO INCREASE THE UPPER GRADES OF THE CORPS IN ABOUT THE SAME PROPORTION AS THE TOTAL INCREASE.

At first glance there does not appear a necessity for so many engineers on the captains' and commanders' list, and yet when we reflect that the percentage of the whole corps on these lists will be no greater than that in the upper grades of the line, we can see a sound reason for the increase. It would only lead to a repetition of the present discontent and uneasiness not to give the engineers the same rewards and pay as are received by the line. The time is past in the Navy when one corps has greater claims to rewards and promotion than another.

Individuals may win great reward and grateful recognition from the country; and because the line officer may sometimes have greater opportunity to display his courage and good judgment in action, it does not follow that we have a reason for giving the whole corps rewards that belong only to the man who wins them. One of the worst features of the service is promotion according to seniority. There is no method of gaining advancement by the display of exceptional qualifications for command or for exceptional constructive attainments. In a few cases since the war the Senate has passed special bills promoting officers for bravery or unusual zeal in the service.

The present Engineer-in-Chief, Mr. Melville, was advanced in that way for his great ability and endurance in bringing his boat crew out of the Lena Delta after the loss of the Jeannette. It seems a pity that the proposed bill should not provide some method of selection for promotion to the higher grades. A man's ability is at present too often rated by his place on the list. If he happens to be number 70 on the list of chief engineers, he knows only four-sevenths as much as the man who is number 40. No method could be better devised to sap the energies of a corps.

The third point in the bill,

TO GIVE MILITARY OR NAVAL TITLES TO ALL OFFICERS OF THE ENGINEER CORPS,

is likely to be even more bitterly opposed than the increase of numbers. There is no certainty of just how far this would improve the status of the engineer. It is altogether likely that its chief merit lies in the fact that it will ultimately bring the line officers and engineers into more helpful and sympathetic relations, a condition devoutly to be wished.

At present the proposition does not promote peace between the two corps, but once a well established law, it would work smoothly, and the present disagreement would be forgotten.

The Engineer Corps, as now organized, has three grades: Chief Engineer, Passed Assistant Engineer, and Assistant Engineer, with certain relative rank given to fix precedence so that there may be no disputes about the order in which officers select their rooms on board ships, march in funeral procession, approach and bow before the President at a New Year's reception or sign their names on official papers. The actual grades above mentioned are essentially civil titles, and have no place in a military service.

We speak of the chief engineer of a railroad or of a ship, of an assistant engineer in a bridge company or on a survey, and the titles have come to have a distinct meaning in connection with civil pursuits. In a military service rank and titles are given, not to indicate an officer's duty, but to classify him, to make plain as far as possible the date of his precedence, to fix the relative responsibility of his duties, and above all to indicate that he holds a position in the military service of the Government. The rank does not necessarily show what a man's duties are.

Although we may usually suppose that a captain in the Navy commands a ship when at sea, we cannot tell from the title what he does on a shore station. Nobody can tell what a lieutenant or an ensign does, as the rank indicates nothing. This explanation is given to show that the bill does not contemplate a revolution of naval methods. It is intended merely to make the service more homogeneous by giving the same rank and titles to all graduates of the Naval Academy who enter the line and engineer corps. This will fix more definitely the right of the engineer to command with his own men, and it will not make one whit's difference in the ship's organization.

The engineer in charge of the machinery will still be the chief engineer, whatever his rank, and the officer in command of the ship will still be captain, if his rank be only ensign. So far as the discipline of the ships is concerned, it would be improved instead of being broken up, as the engineer could not fail to find more ready recognition of his duties and functions.

The principal objections on the part of the line, no doubt in most cases sincere and conscientious, are: That engineers are endeavoring to share the rank and titles that have belonged to the line for generations; that the rank and title will, after the change, give no indications of an officer's duties; that engineers will want to command as soon as they obtain real rank.

The only distinctly naval titles in the Navy are admiral and commodore, the others are practically taken from the Army, and do not belong exclusively to the Navy. The title, captain, may be applied to any one commanding men, or directing the movements of men.

The title, lieutenant, may be applied to any one who acts for the captain, both in the Army and in the Navy, or who aids him in carrying out his duties. In this sense, the engineer is just as much a lieutenant as the man who walks the deck.

One is likely to find it difficult to understand why titles so common in all military services, both on land and on sea, should be so jealously guarded as the sacred birthright of officers of the line of the Navy; especially when the conferring of those titles on staff officers would not detract from the authority of the line. As already stated, these titles, even now, give no indications of the duties.

The bill is very carefully drawn to give no engineers by virtue of their rank the right to command, except when assigned to such command or duty by competent authority. The competent authority would be the President of the United States, the commander-in-chief of a squadron, or the captain of a vessel acting singly. This does not look particularly dangerous to the efficiency of our ships, especially when the detail of an engineer to command will be practically in the hands of the line. There can be nothing disorganizing if the engineer does desire to command. Nobody ever dreams that the service is in danger or even less efficient because the lieutenants and ensigns want to command.

The mere possession of rank does not entitle any man to command unless he be properly detailed to the duty or be ordered to duty which will place him in line of succession to command. There is no doubt that the effectiveness of any military service on land or sea would be destroyed if the commander did not have entire control and entire authority to maintain discipline, or if the line of succession to command were not clearly fixed by law, or by orders of the commander-in-chief.

Along with this entire control must go the right to select any officer for a particular service, or for the command of an expedition, if the commander sees in that officer the man most likely to carry his duty to a successful issue.

As a matter of fact, cases have occurred where the commander of an expedition has taken that right without authority of law. The occasion requiring the detail of an engineer to command will seldom arise; but it is to be hoped that the executive may have power to make such a detail, if he finds it advisable. It will make little difference to the country whether a commander springs from the line or from the engineering corps, provided the best man is selected.

It is freely admitted that the line officer, from the nature of his duties, has greater opportunity to demonstrate his fitness for command, and if the President is to have no discretion in the matter the selective right to be confined to the line rather than to the engineer corps; but the President should have latitude in the matter. If the engineer turns out to be a better and stronger man he ought to command.

Courage, coolness, and the ability to control men does not follow the line of promotion, nor are these qualities confined to one corps. It is a poor kind of patriotism which would limit the executive in his choice, if the safety of an expedition or the honor of the flag depended upon his selection.

As stated above, the struggle now going on is the result of conditions beyond the sailor's control. The methods of propulsion having been revolutionized, a clash was certain to come eventually. The engineer is just as certain to win. It may take years, but our officers are sure to become engineers in the course of time. Anything that hastens the changes and serves to weld the line and engineer corps into one should be welcomed by all officers alike.

By a strange fatality it was an engineer who, more than a century ago, by inventing the steam engine started the train of circumstances that has led up to this struggle in the Navy, and to the far greater struggle of the working people all over the country. It is no exaggeration to say that James Watt has had a far greater influence upon humanity, national life, and even warfare, than Napoleon, Wellington and Nelson. Coming down nearer to our own time, it was the invention of another engineer that changed completely the types of our fighting ships.

As the Navy is constituted to-day, the line officer who inspects steel or designs a gun is already an engineer if he does his work properly, and he is more fitted to command than the man who runs an engine. Just as with the engineer, his power to command is slowly lost if all his time is spent over a drawing board or in running a machine; but that is not the case with either corps. Both have executive duties of a similar nature—the organization and control of men to carry out the work on board ship and in our navy yards.

The writer can conceive of no better way of promoting the efficiency of the service, which he regards as absolutely essential to the welfare of the country, than this plan, which is one step toward bringing the engineer and line officer closer together, so that ultimately there may be as many men as possible on board of every ship capable of handling both guns and machinery.

The next point of the bill,

TO FIX MORE DEFINITELY THE DUTIES OF THE ENGINEER-IN-CHIEF, AND TO PROVIDE FOR ORDERING TWO ASSISTANTS TO THE BUREAU OF STEAM ENGINEERING,

is an administrative detail of no special interest to the public, but it is a provision which will promote the work of the bureau. It is very closely involved with another part of the bill which follows.

This

PROVIDES FOR CHANGING THE TITLE BUREAU OF STEAM ENGINEERING OF THE NAVY DEPARTMENT TO BUREAU OF ENGINEERING OF THE DEPARTMENT OF THE NAVY,

and for placing under its charge all that relates to machinery and its appurtenances used on board of naval vessels, not including gun carriages and torpedoes. This is a plan to bring order out of the chaos of the Navy Department.

At present machinery is placed on board our ships by four different bureaus, all independent of one another. All provide spare parts and stores separately from one another, and all watch one another with some jealousy, fearing that one bureau may steal an engine or pump from another. One can imagine the uniformity of the machines and the common interest manifested. If one bureau happens to be out of oil or waste on board a naval vessel, a transfer of these articles from another bureau may be effected by making out requisitions in quadruplicate and sending them through the proper channels. The whole system is so cumbersome and preposterous that it would fall at once if the country were involved in a war.

The exigencies of the service in time of peace have already made it necessary to place the repairs of machinery, whatever bureau it may be under, in the hands of the engineer. He is made responsible for machines over whose running he has no control. He has only recently been permitted even to examine machinery not directly under his bureau to guard against mishap.

The bill will place all machinery under one head and will utilize to the fullest extent the experience of those men who have had most to do with machinery. This proposition is so businesslike and self-evident that very little comment is required.

The next point—

TO PLACE UNDER THE BUREAU OF ENGINEERING THE INSPECTION OF ALL STEEL MATERIAL USED IN CONSTRUCTION—

is not so plain. There does not seem to be any reason why the naval constructor who uses all the steel plates and frames which go into the hull, and the ordnance men who receive tons of gun forgings and armor should not have a share in this, and it is not entirely clear why the present steel board, changed to include an officer from each of the bureaus of ordnance, construction and engineering, should not do this work efficiently.

The proposition to

PROVIDE AN EXAMINATION FOR PROMOTION FROM EVERY GRADE TO THE NEXT HIGHER

is a wise one. The engineer corps has suffered for years from the lack of this provision by the presence of men on its upper grades who should have been retired.

This point in the bill to

FIX RESPONSIBILITIES OF ENGINEER OFFICERS ON BOARD SHIP

involves no great change from the practice of every ship which is commanded by a man of good sense, with decent consideration for his subordinates. It is intended mainly to prevent the abuse of power in the hands of arbitrary and ill-mannered officers, and to strengthen the engineer in dealing with his men.

The clause to

PROVIDE FOR RETIREMENT AT THE AGE OF SIXTY INSTEAD OF SIXTY-TWO

will help the service, as it represents the gain in age due to climbing up and down engine-room ladders, standing watch in the machinery compartments and inspecting double bottoms. The second part of the provision to retire officers after thirty and thirty-five years of service may frighten Congressmen who fear a large retired list, and may lead to a limit placed on the number of retired officers.

Another clause of the bill

GIVES TO SENATORS OF THE UNITED STATES THE APPOINTMENT OF ENGINEER CADETS AT THE NAVAL ACADEMY.

It would amount to a complete restoration of the old course for engineers instead of the present course for naval cadets who do not separate into special corps until after several years at the school.

The cadets at the Naval Academy are now appointed by the members of the House of Representatives, and this would give the Senate a proportionate representation. There is some advantage in making appointments through the Senate, as it distributes the men more uniformly over the whole country, instead of sending them principally from the great centers of population.

The proposition to

MAKE GRADUATES FROM TECHNOLOGICAL SCHOOLS ELIGIBLE FOR APPOINTMENT IN THE ENGINEER CORPS OF THE NAVY

would for a few years have the effect of placing the Naval Academy in competition with outside schools. There would be a number of appointments from the outside schools while the corps was filling up to the limit proposed, but after that the vacancies available for men in civil life might become somewhat fluctuating in number.

In this point the bill is not clearly drawn and does not make plain the method of appointing men from civil life. Whether they would get in by political pull or by competitive examination does not appear. If well administered, this part of the measure would benefit the technical schools by bringing about greater uniformity, and in some cases by raising their standard.

Any plan such as that permitting

THE ENLISTED MEN WHO HAVE SERVED THREE YEARS IN THE ENGINEER DEPARTMENT TO COMPETE FOR COMMISSIONS ALONG WITH THE ENGINEER CADETS

is in accordance with our democratic institutions. It would certainly induce men to enlist for a cruise in the hope of getting a commission, and would in that way increase the average intelligence and efficiency of the men on board ship.

Those clauses

PROVIDING FOR THE DETAIL OF ENGINEERS TO THE TECHNOLOGICAL SCHOOLS APPROVED BY THE SECRETARY OF THE NAVY, AND FOR THE LOAN OF MACHINERY AND MODELS,

is a slight extension of the law now on the statutes providing for the detail of engineers to colleges. The army is already empowered to loan small arms and equipments to colleges having a military instructor detailed from the Army; the above proposition, therefore, is not new. The officers detailed from the Navy under the old law did much to aid the cause of engineering education all over the country, and there is no doubt that the smaller colleges especially would profit greatly by this governmental aid.

THE PROVISION OF A SUITABLE PLACE FOR ENGINEERING EXPERIMENTS FOUND EXPEDIENT FOR THE BEST INTERESTS OF THE NAVAL SERVICE,

will be of great value. The bill, however, is drawn rather narrowly, as it should have made the experimental station available for experiments of all kinds which would be useful to the country at large.

There are a great many investigations that private establishments cannot afford to carry out, and that the government should undertake if we are to attain preeminence as an industrial nation. The direction of the nature of the experiments should, however, be under a commission appointed by the Engineer-in-Chief of the Navy and the American Society of Mechanical Engineers. The execution of the work planned might very well remain where the bill proposes to place it—in the hands of the Navy Department. The writer believes that such a station could not fail to produce lasting benefit.

The last part of the bill

PROVIDES FOR THE PAY OF THE ENGINEERS.

The rates are based substantially on the present pay of the line of the Navy.

In conclusion, a few points of general interest not specially concerned with this bill may be brought out.

Several years ago an article appeared in one of the service papers on the subject of the engineers. It was written by a lieutenant of the Navy with the approval of a Line Committee, stating that the engineers were entirely wrong in their demands for recognition. He further declared that they could have no careers, as their training was so technical that it confined them to subordinate positions, with which they must be content. It is obvious that no man of sense could write such stuff seriously.

The positions filled by many who have resigned from the Engineer Corps is sufficient proof of their capacity to find careers, and if the line of the Navy or the Department have striven to deny them opportunities to make careers in the service, the Govment has been defrauded by the very men who should look with favor upon everything which tends to elevate and to make valuable to our country the services of their brother officers.

If men are denied adequate recognition, it does not follow that they are not fit for higher rewards, or that their right to remain content with the lot in which it has pleased Providence to place them. It is nonsense like this which embitters the engineer and convinces him that the system which turns out such men is radically wrong.

The Engineer Corps has lost many of its best men within a few years. The officer in the engine-room or fire-room cannot help feeling that he is just as essential to the naval service in time of peace and war as the man who commands a gun division or who looks after deck bright work and the hoisting of ashes at sea.

The bill is intended to aid in building up a reserve of engineers who have been to sea in naval vessels. Under the present conditions of service the most effective method of killing a naval reserve will be to take its members to sea for a year. One experience will be sufficient to content them for the rest of their lives. So far as the daily life on board ship and the personal relations among the officers are concerned there is nothing to complain of. The officers get on well at the mess table and friendships are not confined within corps. It is the official life that makes the Navy trying to the engineer.

The line of the Navy contains many men of high and conscientious aims, whose desires are solely for the good of that service, in which all of us take patriotic pride, but the guidance of affairs relating to the personnel of the Navy is unfortunately in the hands of a few whose lives have been spent mainly in or around Washington, and who pursue their ends with the fanaticism we sometimes find in one converted to a new faith.

The writer, after an experience of nineteen years in the Navy, has a sincere desire to promote its efficiency, and the pleasant official relations which ought to exist among its members. He feels, however, that this would be most easily accomplished by a sympathetic study of one another's needs, and such mutual concessions as would secure united action.

West Va. University

9

RELATION OF THE

Wilson-Squire Naval Engineering and Education Bills

— TO —

SCIENTIFIC SCHOOLS AND COLLEGES AND TECHNOLOGICAL INSTITUTIONS.

The Senate Bill was introduced by Senator Squire, of Washington, Dec. 10, 1895, and the House Bill, by Representative Wilson, of New York, Jan. 10, 1896. Both were referred to the respective Naval Committees.

By the provisions of these bills, the Government proposes to establish and maintain courses of instruction in Naval Engineering in the several scientific and technological schools of the United States; and to so endow and support such courses of instructon, as well as to strengthen the present engineering courses of all such institutions, that they may become recognized as proper fitting schools for its Naval Engineering service. The engineering departments of the State and other colleges and universities are likewise included and benefitted.

(A.) To aid these several institutions in establishing and maintaining, as stated in these bills, a "course of instruction in mechanical engineering" which shall be alike satisfactory to the Engineer-in-Chief and the Secretary of the Navy, the Government hereby provides for all such institutions as will become beneficiaries of this federal aid the following:

(*1.*) *Facilities for instruction in naval and marine engineering and naval architecture*, by the loan or bequest

Government proposes, by the Wilson-Squire bills, to open appointments to the same by competitive examination of engineering graduates from the institutions which become beneficiaries of the previously-noted federal aid. In other words, the Government proposes to obtain competent Naval Engineers and establish and maintain a strong Naval Reserve of Engineers, by the following provisions for the graduates of such accredited scientific and technological schools:

(1.) They may be appointed as Engineer Cadets, in the United States Navy.

(2.) They are then to be given a year of practical naval engineering instruction on board a naval cruiser or other war vessel.

(3.) This is to be followed by another year of practical engineering instruction at a Government Navy Yard, or of advanced professional training at a Government post-graduate school.

(4.) They are then to compete with similarly trained graduates from the U. S. Naval Academy for appointments in the Engineer Corps of the Navy.

(5.) If they pass successfully such competitive examination, and there is no vacancy for their appointment, they are each to receive an honorable discharge from the Naval service and a year's sea pay, of $1200, in cash.

(6.) They may then enlist in the naval engineering reserve, thereby forming an invaluable arm of the Government's reserve of trained men. This will be accompanied with privileges and immunities which they could not have obtained from the Government without such training There will be developed an increasing loyalty to the Naval. service; and such a reserve of naval engineers will be ready for any emergency or duty in time of peace or of war which the Government may wish to call upon them to perform.

The reciprocal benefits of these measures to all engineering education in general and the industrial development of the several States in particular will be evident. Though but few graduates from any one institution may so compete for Naval Engineer appointments, these measures will raise the requirements for admission and graduation, and greatly strengthen, unify and elevate the standard of engineering education and allied branches in all such institutions.

Senate Naval Committee: J. D. Cameron, Pennsylvania, *Chairman.* A. O. Bacon, Georgia; J. C. S. Blackburn, Kentucky; Wm. E. Chandler, New Hampshire; F. T. DuBois, Idaho; C. H. Gibson, Maryland; Eugene Hale, Maine; James McMillan, Michigan; Geo. C. Perkins, California; James Smith, Jr., New Jersey; B. R. Tillman, South Carolina.

House Naval Committee: Chas. A. Boutelle, Maine, *Chairman.* M. Bull, Rhode Island; A. J. Cummings and F. H. Wilson, New York; A. G. Dayton, West Virginia; G. E. Foss, Illinois; U. S. Hall, Missouri; J. F. Hanley, Indiana; J. J. Hart and J. B. Robinson, Pennsylvania; S. G. Hillborn, California; G. W. Hulick, Ohio; H. D. Money, Mississippi; Adolph Meyer, Lousiana; F. C. Tate, Georgia.

West Virginia University.
MORGANTOWN, W. VA.

DEAR SIR:

and the consequent industrial development of the several States which has yet been presented. If it becomes a law it will rank in importance with the Land Grant Act, of 1862, and the Morrill Bill, of 1890, but bestows its benefits upon a greater number of scientific schools, colleges and universities than contemplated or provided for by either of the former bills.

In this connection we specially call your attention to what the bill proposes to do for the young men who shall graduate from such courses as well as for the institution which has thereby become recognized as a proper fitting school for the Naval Engineering service of the Government.

Very respectfully yours,

J. L. GOODKNIGHT, D. D.,
President of the West Virginia University.
WM. S. ALDRICH, M. E.,
Prof. Mechanical Engineering.

Jan. 30, 1896.

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ARMY AND NAVY REGISTER.

THE NAVAL ENGINEER CORPS.

Following is a bill (S 735) introduced in the Senate on Tuesday by Senator Squire "To reorganize and increase the efficiency of the personnel of the Navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval engineering reserve for time of war; to establish a naval engineering experimental station, and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering in the technological colleges of the country."

SEC. 1. That the active list of the Engineer Corps of the Navy shall consist of 18 captains, 25 commanders, 60 lieutenant commanders, 70 lieutenants, 65 lieutenants of the junior grade and 65 ensigns, and a number of engineer cadets as provided by subsequent sections. That there shall be a Chief of the Bureau of Engineering of the Navy Department who shall be director general of naval engineering, and, while holding said office, shall have the rank of rear admiral. That there shall be two inspectors general of naval engineering who shall have the rank of commodore.

SEC. 2. That the director general of naval engineering and the two inspectors general of naval engineering shall be appointed by the President, by and with the advice and consent of the Senate, from the list of the officers of the Engineer Corps of the Navy not below the grade of lieutenant commander, who shall hold office for the term of four years.

SEC. 3. That the duties of the director general of naval engineering shall comprise everything relating to the engineering material and personnel, and that he shall be a member of every naval board concerning the policy of the Navy.

SEC. 4. That the senior inspector general of naval engineering shall be detailed as assistant to the Chief of the Bureau of Engineering of the Navy Department, and in case of the death, resignation, absence, or sickness of the Chief of the Bureau, such officer shall, unless otherwise directed by the President according to the provisions of section 179 of the Revised Statutes, perform the duties of such chief of bureau until his successor is appointed or such absence or sickness shall cease. That the duties of the senior inspector general of naval engineering shall, under the direction of the Chief of Bureau of Engineering, consist of designing and preparing the plans and specifications of all new machinery. He shall also have direct charge of all experimental research in connection with matters relating to the marine, electrical, and mechanical engineering sciences under the cognizance of the Bureau of Engineering. At least once every two years he shall visit those technological schools which shall establish a course of engineering satisfactory to the Secretary of the Navy, and where an officer of the Engineer Corps of the Navy shall be detailed; he shall make such reports as will show their usefulness and efficiency to the naval service. He shall be a member of the speed trial board which shall recommend whether vessels built by private firms shall be accepted by the Government. He shall prepare such forms and books of instructions as will aid the officers of the Engineer Corps in the more efficient performance of their duties. He shall also perform such duties as may be assigned him by the director general of naval engineering.

SEC 5. That the junior inspector general of naval engineering shall be detailed as assistant to the Chief of Bureau of Engineering. That the duties of the junior inspector general of naval engineering shall be under the direction of the Chief of Bureau of Engineering as follows: He shall have the general supervision of all construction and repairs under cognizance of the Bureau of Engineering. He shall have charge of the selection of the various auxiliary mechanical appliances required for naval purposes which are not designed by the Bureau of Engineering, and shall make such experiments from time to time as will secure the naval service the highest types of machines for installation aboard our warships. He shall make periodic visits to the several industrial plants where machines for naval purposes can be built, and shall also visit modern merchant vessels. He shall submit detailed reports to the director general of naval engineering, not only in regard to the efficiency of the various types of machinery, but as to the best manner of their installation. Under his direction there shall be prepared monographs upon subjects relating to the naval engineering profession, which shall be furnished free of cost to all students who are pursuing a course of engineering which shall fit them for appointment as engineer cadets.

SEC. 6. That every officer of the Engineer Corps shall be required, before promotion to the next higher grade, to pass the examination now provided for by section 1493 of the Revised Statutes. All, except those who served in the Civil War, shall also be required, before promotion to the next higher grade, to pass the examination now provided for by section 1496 of the Revised Statutes, as amended by the following section.

SEC. 7. That section 1496, Revised Statutes, be, and is hereby, amended by the addition of the following proviso: *Provided*, That the aforesaid board shall be composed of officers of the same corps as that of the officer to be examined, and that no records other than those which may be on file in the Navy Department from commanders-in-chief, commanding officers, and senior officers of the same corps as that of the officer to be examined shall be accepted as evidence in determining the mental and professional qualifications of the officer to be examined.

SEC 8. That the title of the Bureau of Steam Engineering of the Navy Department is hereby changed to the Bureau of Engineering, and it shall have charge of all that relates to the designing, building, installation, fitting out, repairing, and management of all main and auxiliary steam, hydraulic, pneumatic, electric, and other machinery and their appurtenances used on board of Naval vessels, not including gun carriages, torpedoes, torpedo tubes, and fittings. That the Bureau of Engineering shall hereafter have control of all matters relating to the purchase, inspection, character, and quality of coal, and of all other kinds of fuel to be used for all Naval purposes; and that all tests of such fuel shall be made under the direction of the Bureau of Engineering.

SEC. 9. That all boards for the examination, inspection, or survey of machinery, engineering material, tools, and supplies, or contract therefor, under the cognizance of the Bureau of Engineering, shall, when practicable, be composed exclusively of officers of the Engineer Corps.

SEC. 10. That the senior engineer officer attached to a vessel of the Navy in commission shall command the engineers' division and shall be directly responsible to the commanding officer for the preservation and efficient working of all machinery and appliances under the cognizance of the Bureau of Engineering, for the discipline, instruction, and training of the enlisted men of the engineer's division, and in general for the execution of all details of duty in connection with the engineering department of the vessel. He shall have no authority independent of the commanding officer, and in the performance of his duty shall be regarded as executing the orders of the commanding officer. The officer on duty in the engineering department shall be regarded as the representative of the commanding officer, so far as the duties of the department are concerned

SEC 11. That officers of the Engineer Corps of the Navy shall be placed on the retired list when they arrive at the age of 60 years, and officers so retired shall receive 75 per centum of the sea pay to which they are entitled at the date of such retirement as established by existing law. An officer of the Engineer Corps who has been 30 years in the service may, upon his own application, be placed on the retired list, and shall receive 60 per centum of his sea pay as established by existing law The President may, upon the recommendation of the Secretary of the Navy, place any officer of the Engineer Corps who has been 30 years in service upon the retired list, and any officer so retired shall receive 60 per centum of his sea pay, as established by existing law: *Provided*, That the number of engineer officers retired by virtue of 30 years' service shall not exceed six in any fiscal year.

SEC 12. That each Senator of the United States and each Delegate of the House of Representatives shall nominate candidates for appointment as engineer cadets at the United States Naval Academy in the same manner and under the same regulations as now govern the nomination and appointment of naval cadets by Members and Delegates of the House of Representatives. That the President shall appoint one engineer cadet from the District of Columbia and three at large, as he now appoints naval cadets. Until the number of officers of the Engineer Corps provided for in this Act is reached, each Senator shall be entitled to have two cadets pursuing the prescribed course at one and the same time, but after that number has been reached but one cadet at one and the same time. After the passage of this Act, at the date designated the senior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy. At the same time in the following year the junior Senator from each State shall nominate a candidate for appointment as engineer cadet at the United States Naval Academy, and any vacancy in the preceding year's appointments shall be filled by the Senator who made the original nomination, or by his successor. The third year the senior Senators shall make their second nominations, and the fourth year the junior Senators shall make their second nominations, and thereafter whenever a vacancy occurs until the number of offi cers in the Engineer Corps has reached the limit fixed in this act, when each Senator will be entitled to but one cadet pursuing the course at any one time. The Presidential appointments, one from the District of Columbia and three at large, four in all, and the nominations by the Delegates shall be made one each year, in each case until the positions are filled, and thereafter whenever a vacancy occurs. The Secretary of the Navy shall designate the order in which the Delegates from the Territories shall nominate their candidates. A vacancy in the above Presidential and Delegate appointments occurring during these first four years shall be filled at the date of yearly appointments next following in addition to the original appointments of that year. From the passage of this act and until the class first appointed under its provisions shall enter its fourth year appointments shall be made to the engineer division of the first class of naval cadets at the United States Naval Academy according to the laws in force governing such appointments previous to the passage of this act, except that volunteers only shall be so appointed.

SEC. 13. That on June 30 after the passage of this act, and yearly on the same date, and until the number of commissioned officers allowed by this act has been reached, the number of engineer cadets appointed in the Engineer Corps of the Navy shall be 30 plus the number of vacancies occurring in the Engineer Corps during the year preceding ending May 31. After the number of commissioned officers herein provided for has been reached the number of appointments made on June 30 of each year shall be double the number of vacancies occurring in the lowest grade of commissioned officers in the Engineer Corps of the Navy during the year ending. That graduates of technological schools of the United States whose course of instruction in mechanical engineering may be considered satisfactory by the director general of naval engineering, and approved by the Secretary of the Navy, may be eligible for appointment as engineer cadets in the Engineer Corps of the Navy. That the appointment of engineer cadets in the Engineer Corps of the Navy shall be made from the engineer cadets of the United States Naval Academy at the end of the four years' course and from the graduates of the before-mentioned technological schools. The number of graduates of technological schools appointed engineer cadets, as above provided, is to be equal, until the total number of officers in the corps provided for by this act is reached to 30 less the number appointed from the United States Naval Academy, and, after this limit is reached, to be equal to the excess of the existing vacancies over the number of engineer cadets of the United States Naval Academy available each year. All applications for appointments from civil life must be made to the Secretary of the Navy on or before June 1 of each year. Such candidates must not be less than 19 nor more than 24 years of age, and before appointment must undergo a physical examination before a board of medical officers of the Navy.

SEC. 14. That the engineer cadets appointed in the Engineer Corps of the Navy shall be assigned to cruising ships for one year, and at the end of that year shall be ordered for one year to the various working navy yards or to such scientific post graduate schools as may be established by the Secretary of the Navy, for such practical instruction as may be recommended by the director general of naval engineering and approved by the Secretary of the Navy. At the conclusion of this two years' service they shall undergo a physical examination before a board of medical officers of the Navy and a professional examination at the United States Naval Academy as now prescribed by regulation, and from those who pass, and in the order of merit as shown by that examination, shall be commissioned the engineer officers to fill the vacancies in the lowest grade of commissioned officers of the Engineer Corps of the Navy: *Provided*, That at least one-half of such vacancies shall be filled by graduates of the United States Naval Academy: *And provided further*, That after the number of commissioned officers allowed by this act has been reached, the numb r of officers so commissioned in the lowest grade of the Engineer Corps shall be equal to the number of vacancies occurring in the Engineer Corps of the Navy. Those engineer cadets who have successfully passed the examination but who do not receive commissions shall be honorably discharged from the naval service and shall receive one year's pay, as now provided by law. If the number of vacancies in any year is greater than the number of engineer cadets who have successfully passed the required examination, the surplus vacancies shall be filled from the successful engineer cadets of the following years, as they become available. The pay of engineer cadets shall be the same as that now provided by law for naval cadets, except that they shall receive the rate of pay known as "sea-pay" during the time they are under instruction at the navy yards and scientific post-graduate schools as above provided for.

SEC. 15. That in order to promote the study of marine engineering as contemplated in the previous sections, the Bureau of Engineering is hereby empowered to loan under conditions imposed by the Secretary of the Navy, to such scientific institutions as may establish the course of study herein provided for, and shall give the Navy a corps of trained men as a naval engineering reserve, such models, plans, and machinery as can be spared without detriment to the naval service.

SEC. 16. That sections 1484 and 1485 of the Revised Statutes of the United States be amended so as to read as follows: "Sec. 1484. Officers of the staff corps of the Navy graduated at the Naval Academy shall take precedence in their several corps and in their several grades, and shall take rank with officers of the line of the Navy, according to the dates borne by the diplomas or certificates awarded to them at the completion of the course of study at the Naval Academy before performing service afloat in other than practice ships, and according to their relative proficiency at such dates, as shown by the ratio which the merit mark obtained by each graduate bears to the maximum obtainable mark, and officers who have been lawfully advanced or lost numbers on the Navy Register, shall be considered to have gained or lost rank accordingly. Sec. 1485. The officers of the staff corps of the Navy not graduated at the Naval Academy shall take precedence in their several corps and in their respective grades, and with officers on the line with whom they have rank according to length of service in the Navy."

SEC. 17. That officers of the Corps of Naval Engineers shall not be entitled by virtue of their rank to command in the line or in other staff corps. They shall not be required to perform duty beyond the line of their immediate profession, except when assigned to such command or duty by competent authority.

SEC. 18. That every commissioned officer of the Engineer Corps of the Navy who shall have a regular or supervisory watch in the engine room shall be a ward room officer.

SEC. 19. That the sum of $750 is hereby appropriated to engrave a plate for printing the new commissions which shall be furnished the officers of the Engineer Corps affected by this act.

SEC 20. That by reason of the scarcity of Naval Engineers, all the naval cadets of the engineer division who have completed the course of study at the Naval Academy, and who are now performing duty at sea or elsewhere, shall be ordered to Annapolis at the earliest practicable day for the final examinations preliminary to promotion, and upon passing the several examinations satisfactorily, as required by the Academic Board, shall be commissioned by the President as assistant engineers.

SEC. 21. That for the purpose of providing a suitable place where engineering experiments may be carried on to the best advantage, the naval station at New London, Conn., shall be placed in charge of the Chief of the Bureau of Engineering in the Department of the Navy, who shall, under the Secretary of the Navy, conduct such experiments and make such researches as may be necessary or expedient for the best interest of the naval service. That there shall also be established at this station, which shall be called the United States naval experiment station, a post-graduate course for engineer officers of the Navy and Revenue Marine Service, under such rules as may be approved by the Secretary of the Navy. That the sum of $5,000 or so much thereof as may be necessary, is hereby appropriated, in addition to the regular appropriation now made for the naval station at New London, Conn., to carry into effect the provisions of this section.

SEC. 22. That all laws or parts thereof now in force inconsistent with the provisions of this act are hereby repealed.

HAS EXISTED FOR YEARS

THE STRAIN UPON THE ENGINEER CORPS OF OUR NAVY

INTENSIFIED BY THE NEW WARSHIPS

DIFFICULT TO GET A STATEMENT BEFORE THE ADMINISTRATION.

THE POSSIBLE CONSEQUENCES MAY BE

THE RUINATION OF THE NAVY AND FAILURE IN NAVAL CONTESTS.

[SPECIAL TO THE PUBLIC LEDGER.]

WASHINGTON, Nov. 29.—The following impressive and pathetic letter of Dr. Robert H. Thurston, Director of the Schools of Mechanical Engineering and of the Mechanic Arts of Cornell University, in reference to the personnel of the Naval Engineering Corps, has been received at the LEDGER Bureau. It was suggested by a despatch to the LEDGER on the fatality attending the Engineer Corps of the navy, the consequence of overwork by the officers of that corps.

Dr. Thurston, who was formerly President of the American Society of Mechanical Engineers, is undoubtedly regarded as the ablest authority upon mechanical engineering in the United States. Having no official connection with the service, he writes free of all prejudice and unaffected by personal motives. If his words are true a terrible disaster awaits our ships unless a radical change is made in the organization of the navy. This letter should influence legislation upon naval affairs. It is the strongest letter that has been written upon naval affairs during the past decade, and reads as follows:

Dr. Thurston's Letter.

SIBLEY COLLEGE, Cornell University, Ithaca, N. Y., Nov. 22, 1895.—Sir: I was intensely interested in and greatly distressed by the communication of November 19, in your Washington correspondence, relating to the condition of the Engineer Corps of the navy. I was myself a member of that corps during the civil war, and for a half dozen years or more after its close, and many of the men whose suffering and death you describe were acquaintances, some of them personal friends, and among these were some of the ablest and noblest men that the United States Navy ever knew, and the proportion of noble and able men in the Engineer Corps was always great. I know that the tale is not overdrawn, and that much more might be said, with full justification. The list of officers thus needlessly destroyed might be greatly extended; for it is not since the new navy has been under construction only that the Engineer Corps has been thus overworked and overstrained. This later period has only intensified a strain which has existed in a milder form for many years, and the present crisis is but the culmination of a gradually and steadily increasing pressure, which dates from the earliest days of the steam navy.

The Engineer Corps and Its War Service.

During the war men were ready to meet any and all kinds of danger, hardship and imposition, and resignations were rare, but an exodus began immediately afterwards from the ranks of this corps, which has never wholly ceased. Men have, in many instances, clung to their old employment, and still remain in service, able men, helpful and efficient men, men of talent and culture, who might have done much better in civil life, sometimes through pure sentiment; oftener, I am inclined to think, because sentiment was reinforced by the sanguine expectation—never yet justified by the facts—that justice and a wise expediency would in time rescue them from the obviously impending day of unbearable trial. But the service has for a generation past lost continually by resignation, and its losses have included many of its most valuable officers, most of whom might probably have been retained had wisdom and justice and good feeling marked the legislation of Congress and the policy of the executive department of the service. Of those who have thus resigned I have known many, and I do not now recall a single case in which the officer thus returning to civil life was not greatly advantaged, from a business point of view, by the change. If the existing crisis is not promptly and wisely dealt with every other member of the engineer corps who can find his opportunity will resign, and hard service and the weight of responsibility now thrown upon every one on duty, and in rapidly increasing intensity, will pass the rest either over to the retired list or into the other world. The present condition in this Department of the United States Navy, at least, is discreditable to the Naval Committees of Congress and to Congress itself, a reflection—less deserved, perhaps no less real, however—upon successive Administrations, and especially the latter ones, and upon the responsible heads of the Navy Department of the last generation.

Unavailing Efforts to Secure Relief.

I have personally known the Engineers-in-Chief of every Administration, from 1861 to the present time, and I know that every one of them has faithfully represented the condition of the Engineer Corps to the Navy Department and to Congress, so far as they were permitted, for in many cases their reports have been modified, withdrawn, or actually, in whole or in part, suppressed by higher authority. Whether such has been the case with the present Administration, I do not know, and would not, therefore, imply a suspicion; but it has in earlier years, when I have known more or less of the facts, always been difficult to secure full and complete statements of the testimony before the Administration and even more difficult to get the facts before Congress. The present Engineer-in-Chief has been more outspoken than many of his predecessors; but even his reports, so far as published, give no adequate idea of the nature or magnitude of the existing crisis. As I write his report lies on my desk, and I observe that he simply states that "the number of cadets in the Engineer Division now being graduated by the Academy is not sufficient to supply the vacancies in the corps caused by deaths, resignations and retirements. If some means cannot be devised whereby the Engineer Division at the Academy can be increased, recourse must be had to the technical schools and colleges of the country to fill the vacancies, as the number of engineer officers is now less than allowed by law and very much less than the needs of the service require."

Responsibility for Existing Evils.

This statement reads very mildly, coming from Engineer-in-Chief Melville, and my interpretation of it is that either he has given up in despair of securing a proper and efficient service in the Engineering Department and a creditable Engineer Corps, or his usually outspoken and honest statements and protests against this long-progressing debilitation of the Engineer Corps have been themselves dehabilitated by official pressure. But in any case the responsibility for this fearful injury to the navy and to the country must lie with the Navy Department and Congress. The possible consequences, aside from the destruction of the corps itself and of so many brave and able men in case of the outbreak of the war which so many of our "statesmen" are predicting, are tremendous —a fine navy ruined and probable failure in every naval contest.

Effects of Neglect on the Part of Congress.

While in the midst of this ungrateful task of calling attention to the imminent danger which such neglect of duty on the part of Congress has brought to confront us, I receive my copies of the notices of the Loyal Legion and find among them that of the death of Chief Engineer Whittaker, U. S. N., whose name is also mentioned in your Washington correspondence. He entered the service in 1861 and served throughout the war on vessels in continual activity, and took part in every engagement of the several fleets in which he was employed, from that of the Monitor and Merrimac, where he served on the Minnesota, and at the capture of Forts Hatteras and Clark, and with Farragut in Mobile Bay, to that with Fort Fisher and the fights on the James river. Says this notice: "Chief Engineer Whittaker was a man of strict integrity, close and lasting friendships, and a high-minded and genial gentleman. He was thoroughly familiar with all the bradches of his profession, and was a most efficient and capable officer, receiving the highest testimonials during the war and throughout the period of is active service." The report is signed by dmiral Braine, Lieutenant Commander Lil[illegible] and Chief Engineer Magee, three of the ablest and best officers of the United States Navy. And this is the kind of man that the present condition of the Engineer Corps of the United States Navy is driving to destruction, even in time of peace. What language could possibly properly describe such a state of affairs or characterize the criminal responsibility of those who are responsible for it?

Action by Congress Urgent.

That responsibility does not, I am sure, lie with the Engineer Corps itself. It is composed of the best men that were ever gotten together in any service, and the most convincing testimony of the bravery, patriotism and ability of these officers is found in the fact that they still remain in the service and on duty. The fault does not come of neglect on their part to report the necessity of action on the part of the Department and on Congress. The trouble arises from the fact that their recommendations have been entirely unheeded. Laymen and amateurs have presumed to judge cases which could only be properly decided by experts, and the men who bear the burden and are familiar with the facts and needs have been ignored. I have been more or less familiar with this matter for 30 years and over, and I myself once suffered somewhat from these results of the incapacity of responsible officers of the Government, but the experiences of war times immediately after were as nothing in comparison with those of the faithful and honorable and highly efficient officers now constituting the remnant of the old corps. This matter affects the lives of every engineer officer in the service, of all officers and all men in fact, for no one can say when a ship may be lost, or a battle fail of success through disability of the Engineer Department of some heavy iron-clad. It affects the honor and efficiency of the whole navy, it touches the honor of the nation.

R. H. THURSTON.

[illegible]

AN IMPORTANT BILL.

MEASURE FOR FORTIFYING COAST AND SEAPORT CITIES.

Senator Squire Discovers a Radical Weakness in the Interior Organization of Uncle Sam's Ships—His Bill, Regarded as One of National Import, Is Designed to Correct the Evil.

Special to The Times-Democrat.

Washington, Dec. 30.—One of the most important educational measures presented to Congress in many a day is the bill introduced recently by Senator Squire, of Washington. It is regarded by those interested in the cause of technical education as one of national import, and as a measure which will influence the study of the mechanics, arts and sciences for the next twenty years. President Dabney, of the University of Tennessee, declares it to be founded on patriotism and common sense. In perfecting this excellent measure for fortifying our coast and seaport cities, Senator Squire was compelled to investigate the organization of the navy. A careful review of the strength of our naval resources convinced him that there was a radical weakness in the interior organization of our ships. The conservatism and prejudices of the old navy had interfered with the work of the naval engineer, and the complicated machines which are now installed on board of our battleships would be ineffective in time of battle unless the worth and usefulness of the naval engineer received greater recognition and encouragement. He gave particular consideration to the training of our naval officers, and to his astonishment he found that the Naval Academy at Annapolis was either unable or unwilling to send out a sufficient number of men to supply even the vacancies that were annually occurring in the corps of naval engineers.

With each succeeding year he found that an increased number of ships were in commission, and that the average boiler power of each vessel was greater than that of the ships of preceding years, and yet the number of men in charge of these numerous machines was gradually being reduced by the failure of the academy at Annapolis to do its duty. Paradoxical as it may seem, the institution at Annapolis is sending out so few men to look out for the machinery that a succession of breakdowns has occurred in the list of chief engineers; on the other hand, while the duties of the line officers are decreasing and their responsibilities are becoming less, a surplus number of officers is being sent forth from the Naval Academy. During the last year at least 20 per cent of the chief engineers who are eligible for sea duty have edlapsed under the enormous strain to which they have been subjected. In order to correct such a condition of affairs, and in order to provide for the needs of the future, Senator Squire proposes to supply more engineers to the Naval Academy, and if this is beyond the power of the Naval Academy, then he intends to resort to the scientific institutions of the country for aid in this matter.

Acting upon the repeated recommendations of Commodore Melville, the engineer-in-chief of the navy, and such men as Gen. Walker, of the Institute of Technology, of Boston; Dr. Thurston, the director of Sibley College, of Cornell University, and Prof. Hollis, the director of scientific colleges of Harvard University, as well as such land grant college presidents as Dr. Goodell, of Amherst Agricultural and Mechanical College; Dr. Atherton, of the Pennsylvania Agricultural College, and Prof. Mark Harrington, of the University of the State of Washington, Senator Squire proposes that those scientific institutions of learning which shall establish a course of engineering satisfactory to the Secretary of the Navy shall be empowered to send forth their graduates for appointment as cadet engineers in the naval service.

The young men who shall take such a course of engineering with honor, upon passing a physical examination before a Board of Medical Officers of the navy, shall be sent to sea on board a warship for the period of one year. These cadets will have an opportunity of visiting foreign dock yards, great industrial establishments, and also have the opportunity of becoming acquainted with the complicated machinery of modern battleships. While at sea they are to receive the pay of a naval cadet graduate, which is about a thousand dollars a year. They are also to be subjected to all the discipline and restraint that the graduates of the Naval Academy have to undergo. While serving on board these ships their education will be directed by the chief engineers of the respective vessels. The course of instruction will, of course, be very practical, and ambitious young men will have excellent opportunities of familiarizing themselves with the various forms of marine machinery with which our vessels are equipped.

After the probationary period of one year at sea they will be sent to a post-graduate school of instruction, where they will be made familiar with the history of their profession. In all probability this post-graduate school will be established at New London, Conn., and as such institution will be the centre of marine engineering influence in the United States, the young men who take part in these tests will be greatly benefited. The ablest officers of the engineer corps will comprise the faculty of this post-graduate school, and the country at large, as well as the individuals stationed there, will receive positive information upon what are now disputed engineering points.

At the end of one year of training at the post graduate schools the civilian graduates are to compete with the academy graduates for a commission in the regular corps of the navy. Those who pass a satisfactory examination, but who are debarred from receiving a commission by reason of there being no vacancies in the corps, will be honorably discharged with one year's sea pay of an ensign, which will be approximately about $12[illegible].

With this sum the young man can commence the battle of life, and with the excellent opportunities he has had for acquiring engineering knowledge there should not be much difficulty for him to enter upon a career which will bring him future rewards and honors outside of the naval profession. The government will also be benefited by providing a naval engineering reserve in time of war. It is expected that these young men, who will be the elect of the various colleges, will render an equivalent service for the pay they receive during the period they serve as cadets; so that it can be truthfully said that the scientific colleges of the land will provide an engineering reserve for time of war without cost to the government.

In order to still further encourage the study of the mechanics, arts and sciences, and particularly that of naval engineering, Senator Squire proposes that those colleges which shall establish a course of naval engineering satisfactory to the Secretary of the Navy shall have loaned to them such models and machines that can be spared without detriment to the public service. The machines so loaned would be invaluable for illustrative purposes, although they might not be as economical as some of the modern machines. Instead of selling the engines of old warships for scrap iron, Senator Squire proposes that such machinery shall be loaned or practically given to the various scientific institutions.

In general it may be said that there are four great educational features to Senator Squire's bill, which may be summed up as follows:

First, providing a naval engineering reserve force for time of war without cost to the government; second, the encouragement of the study of the mechanic arts and sciences by providing all those colleges which shall establish a course of naval engineering with a talented officer as professor of engineering science; third, inducing worthy and distinguished young men to pursue the study of naval engineering and rewarding those who have aptitude for the naval service and have marked talents for the profession; fourth, testing the efficiency of the Naval Academy and spurring it on to better work; increasing the usefulness of this institution by compelling it to give a more extended course of engineering and compelling the graduation of more engineers.

A prominent naval engineer, in speaking to The Times-Democrat correspondent of this bill and the prospects of its becoming law, said:

"Representative Meyer, of Louisiana, who is one of the members of the naval committee, will probably be the strongest opponent of this measure, and by reason of his great persistency and application, will leave no stone unturned to prevent the increase of the corps of naval engineers. Mr. Meyer's influence in the naval committee is very strong, by reason of his indefatigable force in and out of the committee room. There has been no educational bill ever introduced in the House or Senate which so strongly affects the industrial development of the South as the measure presented last week by Senator Squire. By reason of the Southern colleges not having a heavy endowment fund, and by reason of the cost of the equipping of scientific laboratories, it will be impossible for the Southern institutions to take up the study of the en-

engineering course to the extent that more richly endowed colleges of the North can do. By having a naval engineer detailed as professor of the mechanical and agricultural colleges of the South that section will be more nearly on an equality with its more favored brethren of the North. The officers detailed to these institutions would be graduates of the United States Naval Academy. The provisions of the Squire bill are such that every scientific institution which shall establish a course of engineering satisfactory to the navy shall have such an officer detailed. The law is compulsory. Yet it is a Louisiana Representative whom the corps of naval engineers to-day believes stands in the way of this measure becoming law. Dr. McBryde, the efficient president of the Virginia Agricultural and Mechanical College, and President White, of Georgia, are enthusiastic advocates of the measure. The direct gain to your Tulane University and other Louisiana colleges would be the detail of an engineer to each of these colleges and the loan and practically the gift of the valuable machine appliances from the national government. It is a remarkable fact that in every university in the United States, and there have been over twenty of them, which have secured the detail of one of these naval engineers, the course of mechanical engineering has been extended to such a degree that the study of the mechanic arts and sciences have become a leading feature of such institutions. Particularly to the South and the West is this measure an important one. The executive committee of the association of land grant colleges have this matter in hand, and they will urge the Fifty-fourth Congress to make the Squire measure a law without delay. If Representative Meyer can be induced to approve this measure one of the greatest obstacles will be removed."

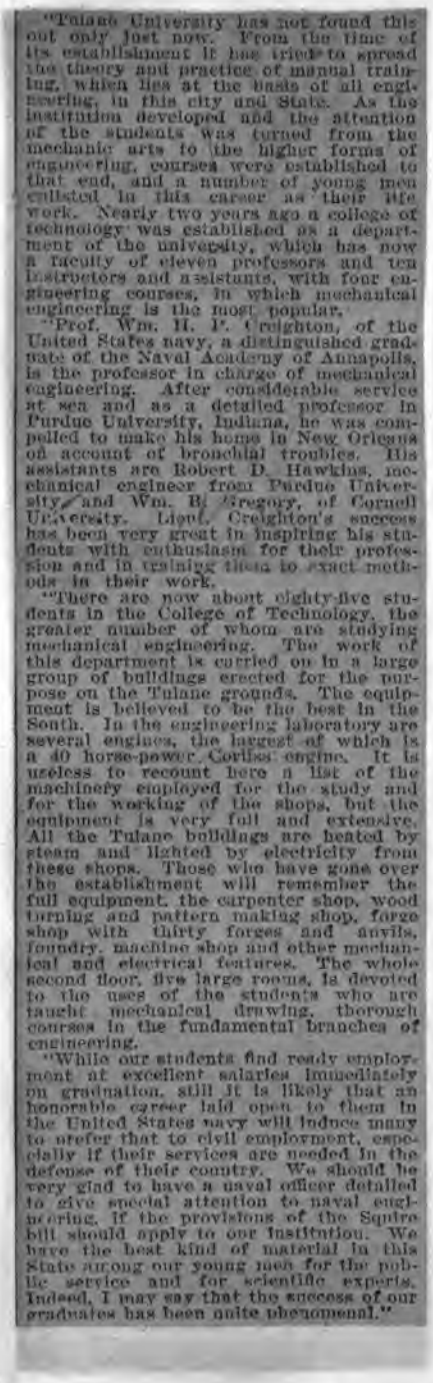
Times-Dem. 9/2/1895

MR. JOHNSTON INTERVIEWED.

President of Tulane University Indorses Senator Squire's Naval Measure.

Mr. Wm. Preston Johnston, president of the Tulane University of this city, was seen in relation to the Squire bill, as outlined in the above. Mr. Johnston, while fully concurring in the probable advancement of the engineering branch of the navy, which would result from the adoption of the project contained in the bill by the government, said that his institution had already taken up mechanical engineering under the direction of an eminent graduate of Annapolis. He added:

"I am not personally sufficiently advised as to the requirements and efficiencies in the engineering staff of the United States navy to express an opinion on that point. There can be no doubt as to the immense importance to the country of a large body of mechanical engineers educated and trained to the highest degree of efficiency. Their services are needed both in war and in peace. In peace they are the right arm of manufacturing and production, and in war, as now carried on, they would constitute one of the most important branches of the public defense.



"Tulane University has not found this out only just now. From the time of its establishment it has tried to spread the theory and practice of manual training, which lies at the basis of all engineering, in this city and State. As the institution developed and the attention of the students was turned from the mechanic arts to the higher forms of engineering, courses were established to that end, and a number of young men enlisted in this career as their life work. Nearly two years ago a college of technology was established as a department of the university, which has now a faculty of eleven professors and ten instructors and assistants, with four engineering courses, in which mechanical engineering is the most popular.

"Prof. Wm. H. P. Creighton, of the United States navy, a distinguished graduate of the Naval Academy of Annapolis, is the professor in charge of mechanical engineering. After considerable service at sea and as a detailed professor in Purdue University, Indiana, he was compelled to make his home in New Orleans on account of bronchial troubles. His assistants are Robert D. Hawkins, mechanical engineer from Purdue University, and Wm. B. Gregory, of Cornell University. Lieut. Creighton's success has been very great in inspiring his students with enthusiasm for their profession and in training them to exact methods in their work.

"There are now about eighty-five students in the College of Technology, the greater number of whom are studying mechanical engineering. The work of this department is carried on in a large group of buildings erected for the purpose on the Tulane grounds. The equipment is believed to be the best in the South. In the engineering laboratory are several engines, the largest of which is a 40 horse-power Corliss engine. It is useless to recount here a list of the machinery employed for the study and for the working of the shops, but the equipment is very full and extensive. All the Tulane buildings are heated by steam and lighted by electricity from these shops. Those who have gone over the establishment will remember the full equipment, the carpenter shop, wood turning and pattern making shop, forge shop with thirty forges and anvils, foundry, machine shop and other mechanical and electrical features. The whole second floor, five large rooms, is devoted to the uses of the students who are taught mechanical drawing, thorough courses in the fundamental branches of engineering.

"While our students find ready employment at excellent salaries immediately on graduation, still it is likely that an honorable career laid open to them in the United States navy will induce many to prefer that to civil employment, especially if their services are needed in the defense of their country. We should be very glad to have a naval officer detailed to give special attention to naval engineering, if the provisions of the Squire bill should apply to our institution. We have the best kind of material in this State among our young men for the public service and for scientific experts. Indeed, I may say that the success of our graduates has been quite phenomenal."

NAVY ENGINEER CORPS

TO BE RECRUITED FROM THE SCIENTIFIC SCHOOLS.

INADEQUACY OF THE NAVAL ACADEMY

TO SUPPLY ENOUGH ENGINEER OFFICERS TO MEET CASUALTIES.

ESTABLISHMENT OF A RESERVE CORPS

THE EDUCATIONAL FEATURES OF SENATOR SQUIRE'S BILL.

[SPECIAL TO THE PUBLIC LEDGER.]

WASHINGTON, Jan. 1.—Since the assembling of the Fifty-fourth Congress there has been unusual interest manifested by members of the Senate and of the House in naval affairs. Repeated inquiries are made at the Navy Department for information not only in regard to the strength of our fleets, but also our ability to withstand attack. The unusual number of bills presented by the members concerning the navy show the general interest taken by the country in our ability to cope with an enemy and to always stand attack. Of all the measures that have been presented, the one that has been received with greatest favor and consideration is the Engineering Personnel bill of Senator Squire, of Washington. It is realized that upon the naval engineer primarily must rest the responsibility for keeping our ships in an efficient condition, and that, if a strong and efficient force is assembled below the protective deck, we can depend upon the men at the guns rendering a good account of themselves if the necessity should arise for such action.

Inadequacy of the Engineer Corps.

During the past year there has been an alarming number of breakdowns in the personnel of the Corps of Naval Engineers, and as some of the strongest men in the corps have been prostrated by overwork the matter has been regarded as a critical one. In general this is the condition of affairs: The institution at Annapolis is unable to graduate sufficient men to supply commissioned officers enough to fill the vacancies which are occurring. With each succeeding year we place a greater number of ships in commission, and each of these vessels exceeds those of former years in boiler power and complicated mechanism. As the boiler power increases there has been a decrease in the number of commissioned officers in the Engineer Corps, due to the fact that the Naval Academy is graduating an insufficient number of men. By reason of the increased work thrown upon the few officers comprised in the corps there has been a succession of breakdowns. The remaining few cannot be expected to do what was beyond the power of an increased number, and so the collapse of the officers will be followed undoubtedly by the disablement of the machinery. Our annual appropriation for naval purposes averages about $30,000,000, and an expenditure of about $1,000,000 has been necessitated for repairs. Unless the corps of naval engineers can be increased the cost of repairs will certainly double, and possibly treble; so that there will be very little economy in withholding an appropriation of about $200,000 to provide for an increased number of engineers, if the failure to do so will cause an extra million or two to be expended to maintain the efficiency of the machinery.

Radical Reorganization Necessary.

In his investigation of the coast defences of our country Senator Squire was impressed with the fact that a radical reorganization of the corps of naval engineers was a necessity. The work of the Naval Academy had to be supplemented, and after careful deliberation the educational measure which now bears his name was presented to the Senate.

It provides that every scientific institution of the United States which shall provide a course of engineering satisfactory to the Engineer-in-Chief and to the Secretary of the Navy shall commence the work of providing a naval engineering reserve for the country. The graduates of such institutions who shall take a course of engineering with honor, shall be appointed by the Secretary of the Navy as cadet engineers. Upon passing a physical examination before a Board of Medical Officers these young men shall be assigned to seagoing ships for the period of one year, and during that time they shall receive the pay of ensigns, which is one thousand dollars a year. While attached to these ships they will have an opportunity of visiting foreign dock yards, great industrial establishments, while at the same time they will become familiar with the machinery of our warships. It is expected that during the time the young men will be on board these vessels they will have an opportunity to conduct tests and to thoroughly acquaint themselves with the engine and boiler appliances.

A Post-Graduate Course for Engineer Candidates.

After cruising about one year they are to be sent back to the United States and then admitted to a post-graduate school, where the theory, as well as the practice, of their profession can be acquired. It is hoped to utilize the naval station at New London for such purposes, and, as the Engineer-in-Chief hopes to establish at that point an experiment school which shall be the centre of marine engineering influence in the country, these young men will have exceptional advantages to post themselves in regard to the engineering profession. Two years from the date of appointment the young men from the technological institutions are to compete with the graduates of the Naval Academy for commissions in the naval service. Those young men who are not fortunate enough to secure commissions, providing they pass a satisfactory examination and show that they have made the most of the opportunities given them, shall be honorably discharged, with one year's sea pay of an ensign, amounting to $1200. It is true that such a law would be of great benefit to the young men who are appointed cadet engineers whether or not they enter the naval service, but it would be of great benefit to the Government also, for it provides a naval engineering reserve for time of war, and those young men who have spent the two years' probationary period at sea will never lose their interest in the service but do much to enlarge the usefulness of the navy.

National Advantages in the Squire Bill.

There are other educational features connected with Senator Squire's bill. By permitting an increase in the Corps of Naval Engineers it will be possible to follow out the spirit of the law of February 26, 1879, which provided that naval engineers might be detailed as professors of mechanical engineering at the several land grant colleges and scientific institutions of learning. From 1880 to 1891 at least thirty colleges availed themselves of the benefits of this law, and as the direct result of that measure most of the young men who were detailed as instructors have resigned from the naval service and now comprise the leading mechanical engineering professors of the country. In leaving the naval service they have not forgotten their interest in the organization to which they once belonged, and to-day those universities at which they are stationed are doing a great work in behalf of naval engineering science. Particularly in the South and West will the detail of these men be extremely beneficial, for the scientific colleges of those States have not heavy endowment funds to carry on the work of their laboratories, and the assistance rendered by the Government in detailing officers of marked ability has been a great inspiration and incentive to the colleges.

An Incentive to the Naval Academy.

Another great educational benefit that will be derived from the passage of the Squire bill is the improvement that it will make in the course of the United States Naval Academy. When the pay of the officers and seamen connected with the institution is taken into consideration, as well as other heavy expenditures, it will be found that the sum required to maintain the Naval Academy is not less than $500,000 per annum. As about 50 graduates are sent out each year, it costs nearly $10,000 to the Government to commission an ensign or a young assistant engineer. By bringing the Academy in friendly competition and rivalry with the outside colleges it will compel the Annapolis institution to do better work, for if her graduates do not surpass those of the technological schools it may be a good reason for abolishing the

Naval Academy. Any school which does not feel compelled to compete with a similar institution must, of necessity, not do the full measure of its work. The bill of Senator Squire will undoubtedly result in the increased efficiency and usefulness of the school at Annapolis.

Four Great Educational Features.

During the past thirty years the Government has made several efforts to encourage the study of the mechanic arts and sciences. One of the great purposes of the Land Grant law was to induce each of the States to give special prominence to the study of scientific matters. This bill was supplemented years ago by the Morrill law. The purpose of these two laws was to strengthen the institutions and indirectly to help the students. The effect of the Squire bill will be to reward the successful student. There is no doubt but that many of the young men who fail to secure commissions in the navy will enter the various shipbuilding plants and engine works of the country, and in this way the valuable instruction which they acquired on board the warships will be utilized in the interest of the nation. It will, therefore, be seen that there are four great educational features to be achieved by the passage of this bill.

First. Providing a naval engineering reserve for time of war without cost to the Government.

Second. Testing the efficiency of the Naval Academy, and finding out its worth as compared with other scientific institutions.

Third. Encouraging the study of the mechanic arts and sciences by detailing as instructors of naval engineering men of ability and learning.

Fourth. Inducing the young men of the country to study naval engineering by holding out an opportunity to secure a commission in the naval service.

Admission to the Navy Broadened.

Of all the civil service bills that have been introduced the measure of Senator Squire is the most practical. It does not provide for a ponderous Board of Examiners and attempt to do the work of others. It encourages the several State institutions to carry on the work in a manner suitable to their surroundings. It offers something substantial to those who shall attempt the work. It is a patriotic measure, and must of necessity bring the naval service in closer contact with the people. It will broaden the sphere of the naval engineering officers, for it will bring them in contact with the strong men who comprise the Faculty of the technological colleges. It will do what no other measure has ever been able to do before, and that is, make it possible for a young man to secure a commission in the naval service without being a graduate of the Naval Academy. It will prove to the country that other institutions besides the Naval Academy are adapted for providing a naval engineering reserve. The scientific institutions of the country will not avail themselves of this measure, however, unless it can be shown them that their graduates, upon entering the naval service, will be accorded the rights and privileges given officers of the line. Senator Squire's bill, therefore, provides that hereafter the naval engineers shall have the rank and titles of their brother officers of the line, and that they shall be accorded all the rights and privileges which are granted the deck officer.

Our navy organization must be radically changed. With the advent of the engineer old things in the shape of fields of snowy canvas have passed away, and if the customs of former centuries are to dominate, then a calamity awaits our ships when they go into battle. The work of the naval engineer can no longer be discredited. His usefulness is of primary importance, and the vessels had better rot at their docks than go to sea with the chief engineer at the beck and call of a dozen captains. To the commanders of the ship alone does Senator Squire propose to subordinate the chief engineer, and his meritorious bill will do greater things for the nation and the naval service than any measure that has been introduced since the close of the war. Pub. Ledger. Phila 7/2/1896 J. M. C.

From the ARMY AND NAVY REGISTER, Washington, D. C., U. S. A., January 4, 1896.

REPAIRS IN THE NAVY AFTER A BATTLE.

This is the age of steel. That of iron has passed long ago. In 1696, he who had predicted that two centuries hence the sea would be dominated by ships of steel; that instead of 8 and 10 knots, these great floating armed steel castles would make 16, 18 and even 21 knots against wind and tide, would have been deemed either a champion liar or a crack-brained dreamer. But so rapid has been the march of inventive genius, in the construction of ships and the addition of new devices, that our older officers of the Navy (those who were educated under the old "jack tar" system, when an officer had to be as much of a "jacky" as the able seaman), are somewhat puzzled to keep up with the march of science, and the multiplicity of the new inventions of these fin-de-siecle days.

The craze for the acquirement of new territory, which seems to have seized upon all continental Europe (with England it has always been a chronic disease), has made great fleets necessary, to defend the newly acquired possession. Fifteen years ago, Belgium—for example—had no colonies. To-day, by a bit of juggle—equal to that of the enterprising Dutchman who purchased all of Manhattan Island for two pairs of breeches—that kingdom has a domain in Africa that is as great as all New England, and the Middle and Western States to the Western boundary of Illinois combined. This she obtained by the aid of H. W. Stanley and other influences, needless to dwell upon here. When the German speaking States were fused into a mighty empire by the nerve of Bismarck, backed by Prussian "blood and iron," united Germany owned no colonial possessions. Now see how they are scattered, from the valley of the Congo and Lualaba to the almost unknown islands of the East Indian or the Australasian Archipelago. So it is with France. But we began this to say that, having these things, means for their defense must be always at hand. See the numberless disputes, and in two instances wars, England's colonial possessions have drawn her into. It is a fine thing to own an empire, on whose proud flag the sun never sets, and whose drum-beats re-echo around the world, but to defend it is an awfully expensive luxury. See what a fighting fleet England has to maintain to uphold her supremacy on the sea, and keep her possessions from being wrested from her. And these ships are all of iron and steel, and the nations are just becoming acquainted with the peculiarities and requirements of the huge fighting monsters that are sometimes as full of coquetries, fads and contrary notions as any fashionable belle or beauty, becoming just a little over-ripe, can be.

Experience alone can teach how best to manage the newest world's acquirement for war on the wave, the steel battle ship. In the days of John Paul Jones, Decatur, the elder Porter, Perry, Preble and others, the question of "repairing damages," after an action, was not deemed one of much difficulty or peril. Some spare timber was always aboard, with a view to such contingencies, and with an expert and ingenious Yankee ship's carpenter, supplementing the practical skill in fixing up fractures the commander had, why the matter of repair after a fight was not regarded with the anxious awe that surrounds it now. Truth is that our Naval officers are only partially acquainted with the new and sometimes fractious material they must deal with, should we ever have occasion to repair ships damaged in action. "You could always tell what good old honest oak would do, what you could expect from it, sir," said one of our oldest retired Naval officers, at his club, the other evening, "but these new materials, iron and steel, are going to puzzle and preplex the naval officer mightily who carries a modern squadron into action, and gets it much damaged. The modern captain, who has an ironclad to command, is very much like a newly married man. He has to learn the temper and tendencies of his vessel, just as a man learns the temper and little weaknesses of his wife, only by daily observation and experience."

Notwithstanding the immense power of the modern man-of-war, its very strength is often its weakness. As a grain of dust in the human eye may produce the most excruciating pain, and render the organ useless for the time, so the breakage of the smallest bolt or rod may paralyze the machinery of the most formidable battle ship. And herein lies the great weakness of these mighty fighting machines. A singularly apt illustration of this is given by Fleet Engineer Quick, R. N., in a most interesting paper, printed in one of the publications of our Naval Institute. Discussing the ease with which a great battle ship could be rendered useless, he cites the following instance: "In 1891, on H. M. S. Trafalgar, the locking bolt of the after turret was broken during the target practice on July 13, 1891, and although the engineers and artificers on board worked steadily, it took three days to repair the broken part, and during this entire period the guns in this turret were entirely useless." Here is an object lesson that everyone can comprehend. The Trafalgar is regarded as one of the most powerful and formidable vessels in the British Navy. She is of about 12,000 tons displacement, her engines are 12,000 horse power, and yet, for three days, one-half the tremendous fighting capacity of this splendid ship is paralyzed, just because a piece of steel perhaps two inches in thickness was of faulty material, or else badly tempered, and gave way at the wrong time. It does not matter why the thing gave way just as it did, that it did is the matter in point, and its breaking was sufficient to reduce the fighting ability of the Trafalgar just 50 per cent. and the damage could not be repaired under 72 hours, though the best metal workers, the most skilled artificers of Her Majesty's Navy, were promptly at hand. Suppose a great sea fight had been going on, one in which English supremacy on the wave was trembling in the balance. What sum could compensate the British nations if the paralyzed guns of the Trafalgar had been able to turn the balance to victory, and were useless at the crucial moment? And in just such things as this broken bolt lie the greatest danger to that, in many respects, the supremest triumph of the modern steel thing, the great sea-going battle ship.

How can these dangers be best avoided, or occurring, how may they most readily, and above all most speedily, be repaired? Time, time is a mighty factor in this question. While a 2-inch bolt is being fitted to its place, the power and prestige of a great nation on the wave may be slipping away. Hence the enormous consequence is a correct practical solution of this question.

The only fight of our time at which the modern steel sea fighting machine was used with intelligence, skill and high courage was that of September last at the mouth of the Yalu between the Japanese and Chinese fleet. But for the English men aboard the Chinese ships there would have been no fight to discuss. From what happened there the naval officers of the world have deduced three or four conclusions. The first is that effective repairing afloat, without the aid of proprer repairing facilities, is out of the question. These facilities are best available in the form of floating work shops under the direction and command of an officer of the engineering department. A 200-pound shell exploded in-board a man-of-war is no more a respected of fine machinery than a rifle bullet is of the human anatomy. This was demonstrated 30 years ago when heavy shell fire was in its infancy. The Confederate ironclad Albemarle with a single 100-pound shell from a Brooke rifle fired into the U. S. S. Sassacus, Captain Roe, killed and wounded 37 men, the greatest destruction on record during our war from a single shot. Since then guns are more powerful and the machinery of a man-of-war more complicated. One of the first naval experts in the world even goes so far as to say that "the modern ship-of-war will not stand more than one strongly contested engagement." Our old time wooden vessels stood three and four such fights as that at the mouth of the Nile, Cape Vincent, Trafalgar, and were good for half score of years after all these. But they did not have to resist the attacks of 800-pound shells, or even 250-pound rifles in those days when they were laid yard arm to yard arm, and the men handiest with the pike, cutlass and pistol won.

But a revenanus a'vous moutous. The admiral of today in case of war would find it as necessary to consider how he was to repair the damages done to his fleet after action as he would to formulate a plan of campaign. As has been stated, in order not to detach the vessels from the fleet that are not very seriously damaged, the floating working ships, with their full complement of skilled artificers, would either be with the fleet at the time it went into action, or if near a friendly port they might await in a harbor close at hand the orders of the admiral commanding These repairing ships would be constructed for the service, and be equipped to do anything in the way of replacing damaged portions of machinery, restoring displaced guns and renewing broken bolts, shackles and repairing damaged turrets. Naturally, certain vessels would have to go to a navy yard, some to be docked, others to have new pieces of heavy machinery replaced that were too badly damaged to be ever restored. But generally the fighting admiral will not send his ships to a navy yard if he can avoid it. One reason would be that, as every experienced commander of a fleet or vessels well knows navy yards, can not be hurried. They are conducted upon a clerico-military system which for many reasons must be adhered to, notwithstanding it may serve to stir the temper of an impatient commander of a fleet, who wants to repair damages in the quickest possible time and get out again to sea. Consequently, unless hulls have to be looked over and new propellers to be fitted or similar serious work is impending, the weary admiral of a fighting fleet will never permit his vessels to get into the hands of a navy yard commandant, for no matter how ready, and willing the commander of the yard might be to expedite matters, he could not get them out of the "official groove," do what he might. It is the system of circumlocution, that is the development of 300 years that controls the world's yards. This country got it from Great Britain. It has its conceded advantages, it produces excellently well considered and delicate work. But to hurry a navy yard force of workmen is out of the question. They are not used to it. It is not a part of "the system."

Where the floating work shop is not available and American ports are near at hand the wise admiral will send his ships that are to be repaired into some harbor that is as near as possible to a great city, anywhere along our Atlantic seaboard, the regular force, at the order of the Chief Engineer of the Navy, could be supplemented readily by skilled bodies of workmen drawn from the machine shops and great iron and steel foundries, locomotive works, constructors of steam engines. Any head of one of these establishments would gladly lend his corps of skilled workmen to the Government in a time of need. Then, too, the private ship yard could be utilized. So that in the hands of a skilled chief engineer with his plans unhampered by officialism the work of restoring and rehabilitating a battle crippled fleet would not be the terrible job it might at first seem to the unskilled civilian. To such ships as could not be brought in near the shore, telephone and telegraph lines might connect them with the land. Under the direction of the trained naval-military engineers this work could be done in an incredibly short time. The great telephone companies would, with ready patriotism, furnish the fleet engineers with skilled electrical workers, when those of the Navy were not numerous enough to meet the demands upon them.

With the battle ship and its multiplicity of machinery of all kinds, the engineer of to-day should be a scientist of the first order. He must be an expert in the strength and tensile power of metals and a skilful electrician. All this knowledge he should be able to bring to bear whenever required. Suppose, at a moment, when the fate of a squadron was at stake, the search light of—say the Indiana or New York, the admiral's flagship—should suddenly give way, and with one of the exasperating tendencies that so often characterize inanimate things for some occult reason obstinately refuse to work? Where would the fleet be if the power to signal at night was suddenly cut off and the engineer was unable to remedy it? The possibility of such things as these have made the position of a naval engineer one of tremendous responsibility. In old times, say in the first years of the war, a man who could run his engines, repair an ordinary breakage, with a fair knowledge of what steam would do under ordinary conditions, was accounted a good engineer. But he would not be in the race now, at all. The Engineer Corps of our navy is as much a scientific body of officers as is the Engineer Corps of the U. S. Army. The men charged with the responsibility for the efficient working of the motive power of a fleet of war ships have about as great a task before them in time of war, especially in action, as can be set for men to do.

And here, it seems proper to observe that the naval engineer and naval constructors' department should go hand in hand. Speaking with that diffidence which so well becomes the uninstructed layman, it would seem to an inexperienced judgment that two or three constructors should be with each fleet, particularly does this seem advisable when making a cruise in which the fleet is liable to go into action. There are many things relating to naval architecture that could be best decided by a clear-headed man's personal observations of phases of cause and effect; say the conditions resultant from the impact of 200-pound shells that can not be decided any other way than by practical observation, that would be most interesting. Then the naval constructor would be at hand to assist practically his brother officer, the engineer, in making such repairs as might be possible at the time the damage was incurred. There are many excellent reasons why several naval constructors should be part of the staff detail to every squadron, which the experienced officer will perceive without further considering the matter here.

The importance of every facility for the immediate repair of the damaged ships of a fleet after action is so obvious a necessity that it requires nothing beyond a brief presentation. It does not matter whether the action has been a heavy or a light affair. And, to do this, an ample force should be available at the earliest possible moment. And, pursuing this idea a little farther, why not have attached to each fleet an engineers' ship? This would be an innovation, but it seems to us a valuable and useful one. Here could be carried everything in the way of repairing material, tools; all, in fact, that any part of the vast variety of the steam, lifting, electrical, hydraulic and other machinery in use to-day on every man-of-war might ever require. Here, too, could be berthed the force of skilled artificers that should be a part of every squadron, that may go into action any day of its cruise. This body of men would be one beside and entirely different from the regular force which is a part of the engineers' establishment. It would always be ready. When, after action, the regular watches of the engineers' department were worn out by lack of rest, overwork and excitement so that they were almost unfitted for the onerous duties that follow a sea battle, they could be relieved by a skilled body of scientific workmen, under their own officers, who knew their work thoroughly and did not need it cut out for them nor require labored instructions before they understood what they had to do. This idea is embryotic, but it seems to be worth consideration from those who could give it life and practically test its utility.

Chief Engineer John R. Edwards, U. S. Navy, has delivered some notably clever lectures, touching mainly naval matters that most deeply interest the Corps of Engineers. From the three we have condensed the above.

MORE ENGINEERS WANTED

A Plan to Increase the Navy's Efficiency.

PROVISIONS OF MR. SQUIRE'S BILL

Congress Will Be Urged to Take Immediate Action to Enlist Civilians in an Important Branch of the Service.

1896

WASHINGTON, Jan. 5.—Before the session is much older a very decided interest will be developed in the bill introduced by Senator Squire to increase the efficiency of the navy by permitting, under certain conditions, the increase of the engineer force by the introduction of the young men graduated by the technical schools of the country. A most impressive recommendation, made by President George W. Atherton of the Pennsylvania Agricultural and Mechanical College; President James H. Smart of the Indiana Agricultural and Mechanical College, and President Henry T. White of the Georgia Agricultural and Mechanical College, has been received here, and it carries an exposition of the bill and the argument for its adoption in brief and complete form.

At the meeting of the Association of Agricultural Colleges and Experiment Stations, held at Champaign, Ill., in 1892, a committee, consisting of Presidents Atherton of Pennsylvania, Smart of Indiana, and Dabney of Tennessee, was appointed for the purpose of representing to the proper committees of Congress the views of the association in support of a measure then pending in the Senate, entitled "A bill to regulate the number of officers in the Engineer Corps of the navy." The committee appeared with representatives of other interests before the Naval Committee of the Senate and received a most courteous and attentive hearing. The Naval Committee, without a dissenting vote, adopted a strong report in favor of the measure and recommended its passage. The bill, however, was not reached on the House calendar during that session, and, though it has been kept before Congress in succeeding sessions, no serious effort has been made to secure its passage, for the reason that existing circumstances from time to time did not seem favorable to such a movement.

On learning that a similar bill was to be introduced at the opening of the present session of Congress, under what was believed to be more favorable auspices, the Executive Committee of the association appointed President White of Georgia as a third member of the committee first named, in the place of Dr. Dabney, whose temporary transference to another post had left a vacancy.

A bill was brought forward by Senator Squire of Washington soon after the opening of the present session of Congress, drawn upon substantially the same lines as the former one, but introducing some changes which, as they affect principally the organization of the Engineering Staff of the navy, do not especially concern the educational institutions of the country.

The bill, as printed, is known as Senate, No. 735, and its full title is "A bill to reorganize and increase the efficiency of the personnel of the navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval engineering reserve for time of war; to establish a naval engineering experimental station, and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering in the technological colleges of the country."

Leaving out of view all that relates to the mechanism of the bill, only those provisions are quoted which directly interest technical institutions and which, if adopted, cannot fail to be of far-reaching importance:

> Sec. 13. That the graduates of technological schools of the United States, whose course of instruction in mechanical engineering may be considered satisfactory to the Director General of Naval Engineering, and approved by the Secretary of the Navy, may be eligible for appointment as engineer cadets in the Engineer Corps of the navy.
>
> That the appointment of engineer cadets in the Engineer Corps of the navy shall be made from the engineer cadets of the United States Naval Academy at the end of the four years' course, and from the graduates of the before-mentioned technological schools.
>
> The number of graduates of technological schools appointed engineer cadets, as above provided, is to be equal, until the number of officers in the corps provided for by this act is reached, to thirty, less the number appointed from the United States Naval Academy, and, after this limit is reached, to be equal to the excess of the existing vacancies over the number of engineer cadets of the United States Naval Academy available each year.
>
> Sec. 14. That the engineer cadets appointed in the Engineer Corps of the navy shall be assigned to cruising ships for one year, and at the end of that year shall be ordered for one year to the various working navy yards, or to such scientific post-graduate schools as may be established by the Secretary of the Navy, for such practical instruction as may be recommended by the Director General of Naval Engineering, and approved by the Secretary of the Navy. At the conclusion of this two years' service they shall undergo a physical examination before a board of medical officers of the navy, and a professional examination at the United States Naval Academy, as now prescribed by regulation, and from those who pass, and in the order of merit as shown by that examination, shall be commissioned the engineer officers to fill the vacancies in the lowest grade of commissioned officers of the

Engineer Corps of the navy. Provided, that at lease one-half of such vacancies shall be filled by graduates of the United States Naval Academy. Those cadets who have successfully passed the examination, but who do not receive commissions, shall be honorably discharged from the naval service and shall receive one year's pay, as now provided by law.

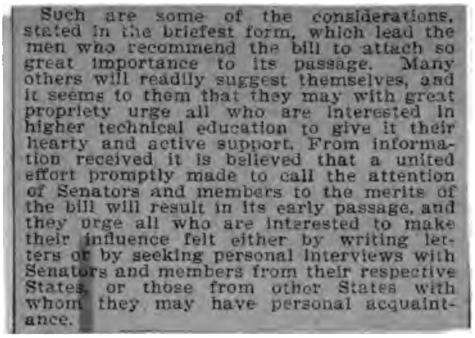
Sec. 15. That in order to promote the study of marine engineering, as contemplated in a previous section, the Bureau of Engineering is hereby empowered to loan, under conditions imposed by the Secretary of the Navy, to such scientific institutions as many establish the course of study herein provided for, and shall give the navy a corps of trained men as a naval engineering reserve, such models, plans, and machinery as can be spared without detriment to the naval service.

Aside from questions affecting the organization of the naval engineering staff, the bill is based upon the fact, which has been repeatedly urged upon the attention of Congress, that the present engineering force of the navy is utterly inadequate to its immediate and imperative needs; and the provisions quoted are intended to make use of existing educational agencies as a means of supplying that deficiency more rapidly than can be done by the Naval Academy alone, under existing laws and regulations.

The measure seems to be one of the very highest importance, not only as respects the naval resources of the country, but still more, if possible, as respects the interests of all institutions of higher technical education which include engineering studies in their courses. It would be possible, of course, to increase the number of cadets in the Naval Academy at Annapolis to such an extent as to provide the requisite number of engineers, but such a policy would involve so important changes of legislation and administration that it seems altogether unlikely to be undertaken, and, even if it were more practicable than it appears to be, it would be regarded as highly inexpedient.

Engineering instruction of a high grade is already provided by numerous institutions in many parts of the country. These institutions have been established, some by private benefactions and some at public expense. The range and quality of their work has immensely advanced within the last few years, and several of them now take rank with the best institutions of their kind in the world. The admission of the graduates of such institutions into the Naval Service would not only provide an additional field of employment for the best of such men, but would immediately awaken a spirit of emulation among all those whose work was to be subjected to the practical test of an examination absolutely uniform for all parts of the United States. The reaction of such a competition upon the Naval Academy itself could not fail to be highly beneficial, but the immediate and practical consideration is that the Naval Service, under the operation of this bill, would be supplied more promptly and more efficiently than is otherwise possible with an ample force of thoroughly trained men.

It seems obvious, too, that the presence in the navy of a considerable number of officers drawn directly from civilian life, after they had received their training in civilian schools, would not only be of advantage to the whole naval engineering profession, but would serve to awaken and maintain among the people of the country a healthy interest in the Naval Service, as one of the great branches of the National Government.



Such are some of the considerations, stated in the briefest form, which lead the men who recommend the bill to attach so great importance to its passage. Many others will readily suggest themselves, and it seems to them that they may with great propriety urge all who are interested in higher technical education to give it their hearty and active support. From information received it is believed that a united effort promptly made to call the attention of Senators and members to the merits of the bill will result in its early passage, and they urge all who are interested to make their influence felt either by writing letters or by seeking personal interviews with Senators and members from their respective States, or those from other States with whom they may have personal acquaintance.

LETTERS FROM THE PEOPLE.

NAVAL ENGINEERS.

New Orleans, Jan. 7, 1896.

To the Editor of The Times-Democrat:

Our Representatives in Congress must always keep the material interests of this section of the country in view. To promote those interests in every way should be a sacred duty which should not be made subservient to any private interests.

"Better education" is the cry of the new South. To compete with the North we must have more and better schools; more and better apparatus and more, if not better, professors. The cost of maintaining the large technical schools of the North is enormous. Many of them, existing for over a century, have millions for endowment and are aided by State bequests of hundreds of thousands yearly.

The value of technical education was early recognized in the North, following the lead of the large continental schools. Dearth of professors caused the presidents of those institutions to call upon the navy for graduates of the United States Naval Academy, and for eight years the chairs of mechanical engineering were held by young and enthusiastic engineers from the United States navy.

Gradual reduction of the numbers of engineers caused their recall. The institutions had benefited in sums ranging from $16,000 to $40,000 and they witnessed this loss with great regret. In many cases, the services of these engineers had been so valuable that they were induced to resign at very much advanced pay. Cornell University, Ann Arbor, the University of Pennsylvania and Harvard are examples.

The law allowing the detail of these officers is still in force, but is inoperative owing to the exceedingly small number of engineers allowed the navy by law. The Bureau of Steam Engineering, recognizing the great value to the service at large by the presence of these officers in the various universities, is anxious to comply with the law and therefore has two bills before Congress asking for an increase in the number of engineers.

Tulane University is vitally interested in this bill, for if it passes we surely will obtain the detail of an officer to duty at the University. The bill further provides large pecuniary aid to further experimental research in mechanical engineering similar to that now allowed the twenty-six experimental stations in agriculture. Further, it permits the loan of apparatus.

The three things most desired by our Southern universities are provided for in these bills, and we earnestly hope that our Representatives will do all in their power to further their passage and their efforts in their behalf will be watched with great interest. These bills are worth tens of thousands to our Southern universities. They must pass.

R. D. HAWKINS,
Tulane University.

Times Dem. ~~New Orleans~~ 1/8/'96

serious effort has been made to secure its passage, for the reason that existing circumstances from time to time did not seem favorable to such a movement.

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A bill was brought forward by Senator Squire of Washington soon after the opening of the present session of Congress, drawn upon substantially the same lines as the former one, but introducing some changes which, as they affect principally the organization of the Engineering Staff of the navy, do not especially concern the educational institutions of the country.

The bill, as printed, is known as Senate, No. 735, and its full title is "A bill to reorganize and increase the efficiency of the personnel of the navy; to increase the usefulness and numbers of the Corps of Naval Engineers; to induce the scientific institutions to provide a naval engineering reserve for time of war; to establish a naval engineering experimental station, and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering in the technological colleges of the country."

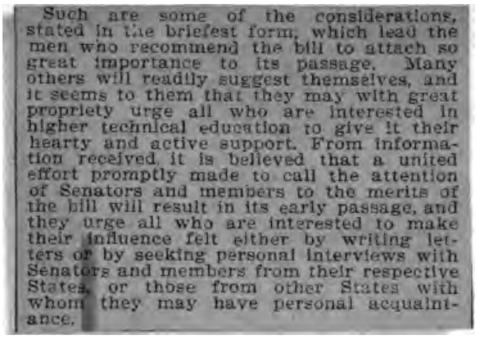
Leaving out of view all that relates to the mechanism of the bill, only those provisions are quoted which directly interest technical institutions and which, if adopted, cannot fail to be of far-reaching importance:

> Sec. 13. That the graduates of technological schools of the United States, whose course of instruction in mechanical engineering may be considered satisfactory to the Director General of Naval Engineering, and approved by the Secretary of the Navy, may be eligible for appointment as engineer cadets in the Engineer Corps of the navy.
>
> That the appointment of engineer cadets in the Engineer Corps of the navy shall be made from the engineer cadets of the United States Naval Academy at the end of the four years' course, and from the graduates of the before-mentioned technological schools.
>
> The number of graduates of technological schools appointed engineer cadets, as above provided, is to be equal, until the number of officers in the corps provided for by this act is reached, to thirty, less the number appointed from the United States Naval Academy, and, after this limit is reached, to be equal to the excess of the existing vacancies over the number of engineer cadets of the United States Naval Academy available each year.
>
> Sec. 14. That the engineer cadets appointed in the Engineer Corps of the navy shall be assigned to cruising ships for one year, and at the end of that year shall be ordered for one year to the various working navy yards, or to such scientific post-graduate schools as may be established by the Secretary of the Navy, for such practical instruction as may be recommended by the Director General of Naval Engineering, and approved by the Secretary of the Navy. At the conclusion of this two years' service they shall undergo a physical examination before a board of medical officers of the navy, and a professional examination at the United States Naval Academy, as now prescribed by regulation, and from those who pass, and in the order of merit as shown by that examination, shall be commissioned the engineer officers to fill the vacancies in the lowest grade of commissioned officers of the

it is at the same time the duty of the United States to assist the colleges in this course of study as the act of 1879 contemplated, and to its advantage to do so.

The South is particularly interested in the passage of the proposed acts on this subject. The Northern colleges have profited in the past by the detail of naval engineers as instructors, but those of the South have not obtained this assistance, but are anxious to secure it now. Tulane University, for instance, would, if the law were passed, apply at once for an instructor and for such other assistance as it is proposed that the Federal government shall give.

The South would, therefore, be one of the leading beneficiaries; and for that reason the bills should have the support of all the Southern Congressmen. Louisiana certainly expects its Senators and Representatives to assist it in this matter, to enable Tulane University to secure the detail of a naval engineer, and Louisiana to turn out men for this service. Senators Caffery and Blanchard ought to give the bills all the assistance they can. Gen. Meyer, as a member of the naval committee, is in a position to materially assist in the passage of this legislation, which is so earnestly demanded by his constituents. We feel confident that they and our other Congressmen can be counted on to do what is wanted of them in this urgent and most important matter. Times Dem, N. Orleans 1/8/1906

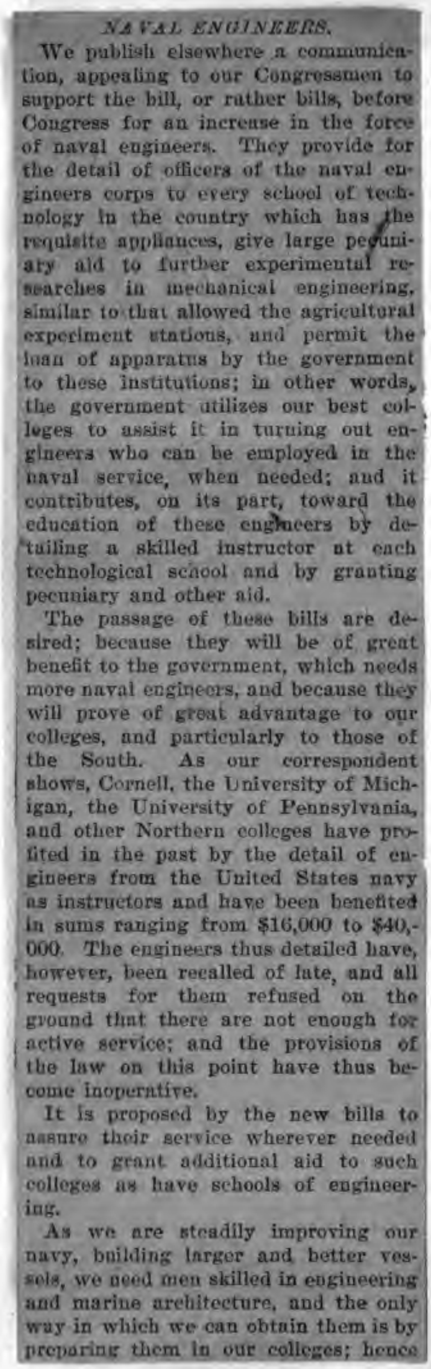


Such are some of the considerations, stated in the briefest form, which lead the men who recommend the bill to attach so great importance to its passage. Many others will readily suggest themselves, and it seems to them that they may with great propriety urge all who are interested in higher technical education to give it their hearty and active support. From information received it is believed that a united effort promptly made to call the attention of Senators and members to the merits of the bill will result in its early passage, and they urge all who are interested to make their influence felt either by writing letters or by seeking personal interviews with Senators and members from their respective States, or those from other States with whom they may have personal acquaintance.

on the Indiana as elsewhere, probably.

Another curious and very unjust feature of the new regulations is that, under them, a machinist who has served one term of enlistment and has been advanced to the first grade, must, if he re-enlists, begin at the bottom again and wait for promotion, unless he immediately re-enlists, or happens to be assigned to certain special or exceptional service.

Engineer officers who have been through Annapolis and have had the same military and other training there that has been received by line officers are better prepared to contend for the rights of the engineer corps on board ship than machinists possibly can be and that explains why line officers are so very anxious to show that the steam engine department of a naval vessel should be in charge of machinists, and that no engineer officers should be aboard the vessel.



NAVAL ENGINEERS.

We publish elsewhere a communication, appealing to our Congressmen to support the bill, or rather bills, before Congress for an increase in the force of naval engineers. They provide for the detail of officers of the naval engineers corps to every school of technology in the country which has the requisite appliances, give large pecuniary aid to further experimental researches in mechanical engineering, similar to that allowed the agricultural experiment stations, and permit the loan of apparatus by the government to these institutions; in other words, the government utilizes our best colleges to assist it in turning out engineers who can be employed in the naval service, when needed; and it contributes, on its part, toward the education of these engineers by detailing a skilled instructor at each technological school and by granting pecuniary and other aid.

The passage of these bills are desired; because they will be of great benefit to the government, which needs more naval engineers, and because they will prove of great advantage to our colleges, and particularly to those of the South. As our correspondent shows, Cornell, the University of Michigan, the University of Pennsylvania, and other Northern colleges have profited in the past by the detail of engineers from the United States navy as instructors and have been benefited in sums ranging from $16,000 to $40,000. The engineers thus detailed have, however, been recalled of late, and all requests for them refused on the ground that there are not enough for active service; and the provisions of the law on this point have thus become inoperative.

It is proposed by the new bills to assure their service wherever needed and to grant additional aid to such colleges as have schools of engineering.

As we are steadily improving our navy, building larger and better vessels, we need men skilled in engineering and marine architecture, and the only way in which we can obtain them is by preparing them in our colleges; hence more especially with the engineer who deals with dynamic problems, which concern the existence of the navy.

The bills of Senator Squire and Representative Wilson, which make an experiment school one of the features of the reorganization of the naval engineering personnel, has been supplemented by special bills for the maintenance of such stations, by Senator Hawley and Representative Russell, of Connecticut.

Since the introduction of these measures many inquiries have been made as to their full scope and purpose. Much experimental research, affecting not only the navy directly, but all the large mercantile shipping interests as well, will be carried on at said school.

QUESTIONS TO BE SOLVED.

Some of the questions to be solved at such a station are the following:

The best form of water-tube boilers for marine purposes; the shape and size of propellers for different forms of vessels; the best type of pump for the manifold purposes required on board ships; the relative merits of natural, forced, and induced draft; the theory and best manner of lubrication; the relative value of various fuels; the advantages and disadvantages of liquid fuel; the determining of the best means of working the turrets of modern battleships; the conditions under when hydraulic, pneumatic, and electric appliances are best adapted.

These are only a few of the questions which must be solved by the engineer, and which are beyond the province of others to investigate.

To the credit of the corps of naval engineers it may be said that pressing questions of engineering science have been met with a willing spirit. To secure the full measure of his talents, however, systematic work is required, and this can only be done in a specifically appointed place, given up entirely to experimental work.

There are questions relating to marine engineering which are beyond the means of private research, and those affecting the navy can only be satisfactorily settled by experiment at such an institution.

As it is now realized that the work of the Naval Academy must be supplemented by reason ,of that institution being unable to send out sufficient men, recourse must be had to the scientific institutions of our land. A post-graduate course of instruction must be given these young men. There will be no necessity to teach them mathematics and the principles of chemistry, but the instruction required must be of a more practical character, which can only be given by the engineer.

WHAT IT WILL BE.

At the experiment station, at New London, there will be a corps of highly-trained professors, who will give a properly prepared course of lectures on the management and the care of machinery. The young men will be taught how to estimate the time and cost of work. They will aid in the practical work of trial trips, assist in the numerous experiments, and keep carefully-prepared note-books. They will visit the great machine building plants in the vicinity of this industrial centre, and actively co-operating with them will be the young men and professors of the scientific colleges of our land. The cadets would thus not only acquire knowledge of incalculable benefit.

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COMMODORE MELVILLE.

The great works at Essen, Germany, which employ 20,000 men, are under the administration of an engineer, and there are scores of plants in America where the executive ability of an engineer directs the energies of thousands of men. The gratuitous insult that Commodore Melville, by reason of being a trained scientific engineer, is not competent to take charge of the station at New London will be resented, not only by the excellent technical schools of the country with their many thousands of students, but the great manufacturing industries of the nation will highly commend that law which places in his charge a station which has been neglected in the past, and which gives promise of great things in the future, if utilized as an experiment station. Not only the representatives of New London, but the representatives of the surrounding States, should give this measure immediate consideration, for the establishment of such a school will transfer the naval engineering educational centre of the world to America.

In determining the proper form of water-tube boilers for naval purposes, it would be economy on the part of the Government to expend at least a quarter of a million dollars, for the efficiency and endurance of the boilers of battleships costing tens of millions of dollars may be determined from the result of such experiments. This will give some idea of the scope and character of the great work laid out by Commodore Melville, the presidents of the land-grant colleges, and the scientific educators and investigators of our land.

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LAND GRANT COLLEGES.

SCHOOLS SUPPORTED BY GOVERNMENT FOR MILITARY TRAINING.

The Engineering Societies Taking Much Interest in the Proposed Experiment Station and Post-Graduate School.

WASHINGTON, Jan. 15.—Special.—The Association of Land Grant Colleges of the United States and the great engineering societies of the country are taking a decided interest in the proposed Engineering Experiment Station and Post-Graduate School to be established at the Government reservation at New London, Conn.

Many scientific men have believed that such an institution already exists, and this belief has been probably due to the valuable desultory work which has been done under the direction of Commodore Melville, but which he has been unable to continue by reason of lack of funds.

The bill introduced in the Senate by Senator Squire and in the House by Representative Francis H. Wilson, of Brooklyn, proposes to supply this omission in a satisfactory and highly economical manner, and do for the vast engineering interests of the navy and the nation what has already been done for other branches of the Government service.

There is now in operation for the army an engineering post-graduate school at Willit's Point, an artillery school at Fort Monroe, an ordnance testing station at Sandy Hook or Fort Hancock, a cavalry and infantry school at Fort Leavenworth, and a medical museum in the city of Washington—all intended for the better instruction of military officers.

THE NAVY SCHOOLS.

The navy has several schools where post-graduate instruction is afforded the line officers. There is a war college and torpedo school at Newport, R. I.; an ordnance instruction school in connection with the great gun shop at the Washington navy-yard, and an ordnance testing station at Indian Head, on the Potomac. There is also a post-graduate school of laboratory work for the surgeons at the Brooklyn navy-yard, as well as a museum of hygiene for the same corps at the Capitol. The marine corps has an excellent post-graduate school of instruction at the Washington barracks.

By reason of the exceeding jealousy entertained by the line officer for the naval engineer, there has been no school provided for the officers of the most highly trained and scientific branch of the navy. The expert in mechanical matters is, therefore, without suitable means or place for doing experimental work or for securing an advanced education in his profession. In no field of professional work is the assistance of experiment of so much consequence and of such great value as in the field of the engineer, and

Brooklyn Daily Eagle

The Passing of the Sailor. 1/17/96

Before the close of the year Great Britain will commission a war ship, wherein the engineers force of the vessel will comprise about one-half of the complement of the entire crew. In the early days of the civil war, when the wooden frigates had steam as the principal motive power, the fire room and engine room force did not comprise 10 per cent. of the men on board. The great change in the proportion of seamen and firemen that has thus been brought about during the past thirty years, must command attention, and those readers who found ineffable pleasure in reading the tales of Marryatt, Cooper and Clark Russell must realize that the romance of the sea has forever departed, and that in this practical age the expert rigger and jovial sailor have given away to the skilled mechanic and sturdy fireman. The necessity for a radical reform in the organization of ships-of-war has been shown in the increased duties which have come to the engineer and the narrower field which the line officer is gradually occupying. There has therefore been a necessity for an increase in the number of engineers and a reduction in the number of deck officers.

A careful examination of the navy register of 1861 shows that we had at the beginning of the civil war 52 sailing vessels and 36 steamships in commission. On board these men-of-war were 667 line officers and 174 engineers. The proportion is wonderfully analogous to the strength of the respective corps at the present time, when we have 710 line officers and 172 engineers.

The severe work entailed upon the engineers during the successive years of the war made it compulsory upon the part of the navy department to increase their numbers relative to that of the line, and in the navy register of 1865, the official authority upon the subject, we find 2,463 line officers and 2,279 engineers, the strength of the two corps thus being nearly equal.

The historic flagship, Hartford, a vessel of about 3,000 tons, was installed with but they would also secure that self-possession, which knowledge gives.

For years the great engineering societies of the United States have been hoping for the establishment of such an institution. It has been reserved for Senator Squire, of Washington, and Representative Wilson, of New York, in connection with the members from Connecticut, to lay out a plan of work which is essential to the engineering needs of the service, and which may have an important effect in building up our commercial marine. The great ship-building plants of America look with favor upon the measure. The patient investigators at the great scientific schools hope that the bill will soon become a law. Commodre Melville and his trained assistants are in need of such a station, where engineering tests can be carried on.

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Brooklyn Daily Eagle

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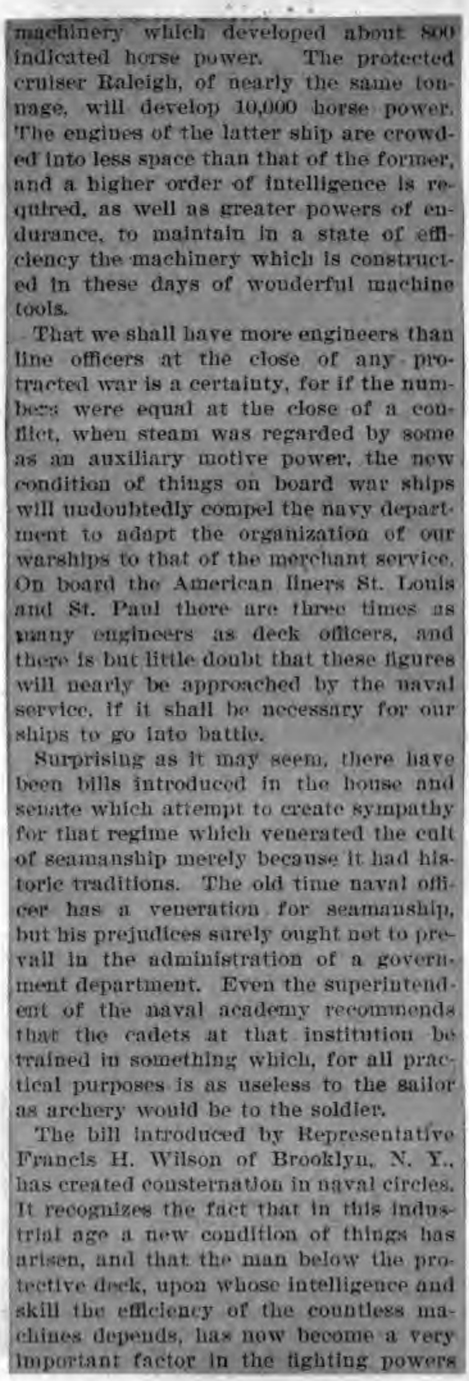


machinery which developed about 800 indicated horse power. The protected cruiser Raleigh, of nearly the same tonnage, will develop 10,000 horse power. The engines of the latter ship are crowded into less space than that of the former, and a higher order of intelligence is required, as well as greater powers of endurance, to maintain in a state of efficiency the machinery which is constructed in these days of wonderful machine tools.

That we shall have more engineers than line officers at the close of any protracted war is a certainty, for if the numbers were equal at the close of a conflict, when steam was regarded by some as an auxiliary motive power, the new condition of things on board war ships will undoubtedly compel the navy department to adapt the organization of our warships to that of the merchant service. On board the American liners St. Louis and St. Paul there are three times as many engineers as deck officers, and there is but little doubt that these figures will nearly be approached by the naval service, if it shall be necessary for our ships to go into battle.

Surprising as it may seem, there have been bills introduced in the house and senate which attempt to create sympathy for that regime which venerated the cult of seamanship merely because it had historic traditions. The old time naval officer has a veneration for seamanship, but his prejudices surely ought not to prevail in the administration of a government department. Even the superintendent of the naval academy recommends that the cadets at that institution be trained in something which, for all practical purposes is as useless to the sailor as archery would be to the soldier.

The bill introduced by Representative Francis H. Wilson of Brooklyn, N. Y., has created consternation in naval circles. It recognizes the fact that in this industrial age a new condition of things has arisen, and that the man below the protective deck, upon whose intelligence and skill the efficiency of the countless machines depends, has now become a very important factor in the fighting powers of the vessel. Realizing the fact that thousands of highly trained and skilled engineers will be required in time of war, Representative Wilson proposes to enlist the active and immediate co-operation of the hundred scientific schools of the country. Co-operating with him are the presidents of the respective land grant colleges and other scientific institutions of the country. The institution at Annapolis is dominated by a sentimentality, which endeavors to uphold the tradition of Nelson and his contemporaries. Forgetting the fact that had such men as Nelson and Farragut lived to-day they would be in the front rank of those insisting that speed and horse power are weapons, and they would say that primarily the usefulness of a war vessel would be measured by the skill of her engineers.

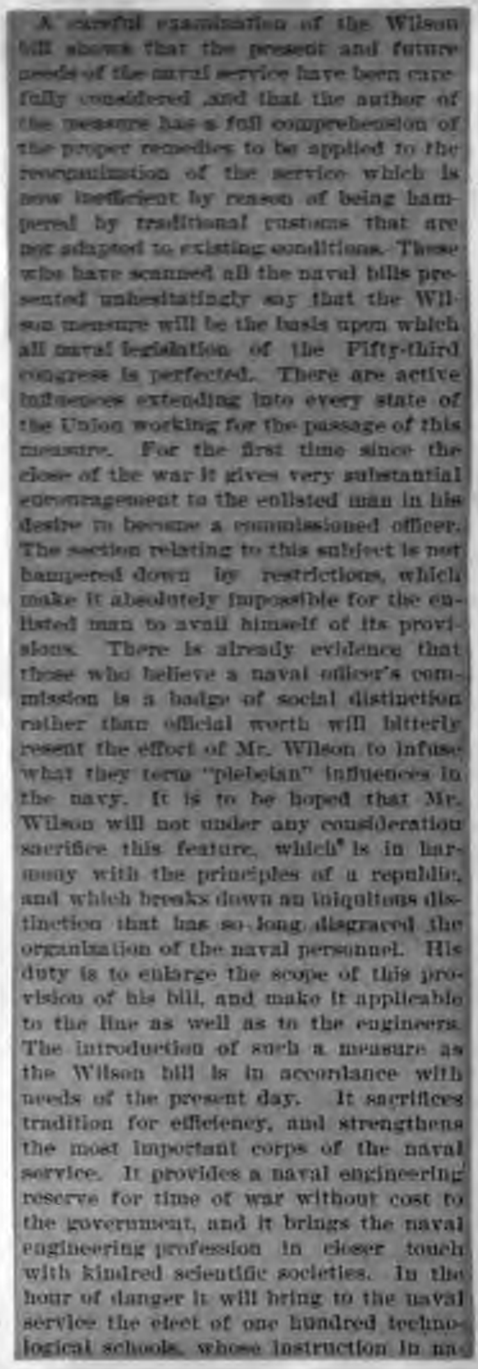
Despite the fact that it costs the government at least one half million dollars every year to graduate thirty cadets for the naval service, the institution at Annapolis is unable or unwilling to commission more than eight to ten assistant engineers each year; a number barely sufficient to look out for the machinery of the two commerce destroyers Columbia and Minneapolis. Such work is trifling with a great question, for in time of danger hundreds will be required, and it seems to tax the ability of the naval academy to furnish ten.

General Francis A. Walker of the Institute of Technology of Boston, Dr. Robert H. Thurston of Sibley college of Cornell university, and scientific educators of equal prominence are amazed at this condition of affairs. The earnest appeal of Commodore Melville, for more men, in order that the great battleships may be kept in readiness, has been taken up by these men, who view the matter not only from an educational standpoint, but from the point of view of patriots interested in the defense of our country.

For many years the weakness of the academy at Annapolis has been known to the scientific educators of our land, and Representative Wilson demands that the worth of these graduates be compared with those furnished by other scientific institutions. The naval academy is to be brought into friendly competition with other schools of learning, and it is a well known fact that the abolition of the academy is inevitable, unless the course of instruction be stimulated. The Wilson bill is a development of the one introduced by Senator Squire of Washington. It contains at least five new features, any one of which entitles it to special support, but collectively make the measure the most important relating to naval affairs that has been introduced during the session. It places in the hands of the engineer-in-chief the inspection of steel for the ships of the new navy, thus doing away with the odium that has been cast upon the incompetent inspectors who have heretofore had charge of this work. The careful inspection of material for our war ships will result in a great financial saving and prevent the numerous scandals that have been connected with the operations of the steel board.

It gives to the staff officer the honors and rewards that are his just due, for as the naval laws now in operation permit every line officer to retire at the close of life's work with the rank of rear admiral, it is but just that his brother officer of the staff shall be permitted to secure the rank of commodore.

It recognizes the fact that the enlisted man in the American navy is capable of attaining high honors, if the opportunity is given to him. It will put new life into the seaman apprentices of the service, for the meritorious and deserving will realize that a commission is in store for them if their conduct and talents merit such promotion. It relieves stagnation in the staff of the navy by permitting those who have been thirty-five years in the service honorably to retire. It compels the navy department to detail to every scientific institution of the land which shall voluntarily pledge itself to training scientific marine engineers, under conditions imposed by the secretary of the navy, an engineer officer as professor of marine engineering and naval architecture. This will be of great benefit to those schools which have not secured a heavy endowment fund.



A careful examination of the Wilson bill shows that the present and future needs of the naval service have been carefully considered ,and that the author of the measure has a full comprehension of the proper remedies to be applied to the reorganization of the service which is now inefficient by reason of being hampered by traditional customs that are not adapted to existing conditions. Those who have scanned all the naval bills presented unhesitatingly say that the Wilson measure will be the basis upon which all naval legislation of the Fifty-third congress is perfected. There are active influences extending into every state of the Union working for the passage of this measure. For the first time since the close of the war it gives very substantial encouragement to the enlisted man in his desire to become a commissioned officer. The section relating to this subject is not hampered down by restrictions, which make it absolutely impossible for the enlisted man to avail himself of its provisions. There is already evidence that those who believe a naval officer's commission is a badge of social distinction rather than official worth will bitterly resent the effort of Mr. Wilson to infuse what they term "plebeian" influences in the navy. It is to be hoped that Mr. Wilson will not under any consideration sacrifice this feature, which is in harmony with the principles of a republic, and which breaks down an iniquitous distinction that has so long disgraced the organization of the naval personnel. His duty is to enlarge the scope of this provision of his bill, and make it applicable to the line as well as to the engineers. The introduction of such a measure as the Wilson bill is in accordance with needs of the present day. It sacrifices tradition for efficiency, and strengthens the most important corps of the naval service. It provides a naval engineering reserve for time of war without cost to the government, and it brings the naval engineering profession in closer touch with kindred scientific societies. In the hour of danger it will bring to the naval service the elect of one hundred technological schools, whose instruction in naval engineering will be directed by the officers detailed to such universities as professors of that branch of engineering. It breaks down that Chinese wall of prejudice which has interfered with the full development of the scientific officer of the naval service. It recommends itself to all those interested in the development of the study of mechanic arts and sciences, and when the measure comes up for discussion the talented representative from Brooklyn will receive strong support from the leaders of both parties in the halls of the congress.

It is regarded by the technological schools of the country as the best educational measure that has ever been presented, and the presidents of these scientific institutions will demand a hearing when the sub-committee gives consideration to the bill. Viewed either from an educational or military standpoint, these scientific authorities declare that it concerns the defense of the country and they will bring indisputable evidence that the measure is a necessity to the efficiency of our warships. There is not a state in the Union which has not a personal interest in the passage of this bill, for the development of their respective scientific colleges will have an important effect upon the upbuilding of their manufacturing industries. It is upon educational and patriotic grounds, however, that the scientific institutions ask for the speedy enactment of the bill into a law.

Brooklyn Daily Eagle 1/7 1896.

DISCORD IN THE NAVY.

The Bitter Fight Between the Line and Staff.

THE ENGINEERS WANT RANK.

But the Line Would Withhold It from Them.

The Battle Royal Was Begun in the Fifty-third Congress and Both Sides Are Determined that It Shall Be Settled Now for All Time—Bills Introduced by Senator Squire and Representative Wilson.

[Special Dispatch to the Baltimore Sun.]

WASHINGTON, Jan. 19.—Quarrels among naval officers are not of recent origin. Ever since Drake hung Doughty for intrigue and insubordination, navy officers would seem to have regarded it as an especial prerogative of their profession to quarrel among themselves. Jealousy of the rank of others seems to have been the cause of most of these quarrels. Oftentimes these wrangles have defeated important naval bills. Generally the promoters of these quarrels were prompted by selfish motives. For the past thirty years there has been a struggle between the line and staff of the navy, which increases in intensity each succeeding year, and which will, it is said, be fought to a finish in the Fifty-fourth Congress. Public men now realize that the tendencies of this quarrel are becoming more harmful and that the time has now come when there should be an end to the unseemly contention.

The average American has about as much knowledge of the merits of this question as Lord John Russell said the people had of the Schleswig-Holstein dispute.

What Constitutes the Personnel.

What may be called the personnel of the navy is divided into two parts—the sailor officers and the staff. Surgeons, paymasters, constructors, chaplains and engineers comprise the staff. Captains and watch officers or mates comprise the line. The proper duties of line officers are to command navy-yards and vessels of the navy, to navigate and sail the ships, do the astronomical work afloat and carry on the general ornamental duty of the ship. The general duties of the surgeons and paymasters are familiar to all. The constructors seldom go to sea, and as they have charge of the building of hulls their quarrel with the line is limited to the contentions which they have in the construction of ships. The engineers design and superintend the construction of steam and other machinery of the navy. They have also the care and management of these machines at sea, and, like their brother officers of the line, there are numerous duties for them to do at the several shore stations.

It has been regarded as essential to this corps that it possess the best engineering talent the country affords, for on a warship the machinery must not only be exceedingly light, but is crowded into smaller space than in the merchant service.

Line Opposed to Engineers.

Officers of the line are determined that the engineer of the navy shall neither have positive rank and titles, nor shall he exercise military authority in his own department, but that everything relating to the organization of the vessel shall remain in their hands alone, as it has existed since the day they came on board the ship. A battle royal between the two forces commenced with the assembling of the Fifty-third Congress, and both sides have gone into the fight with the determination to settle this question during the coming six months for all time to come. Powerful influences are supporting the line. They surpass the engineers in numbers, patronage and influence at the department. The engineers are supported by powerful educational and manufacturing interests.

The measures introduced by Senator Squire and Representative Wilson are far-reaching in their effects. One section forces the Naval Academy into competition with the outside scientific institutions in supplying officers for the engineer corps. Provision is made for securing a great naval engineering reserve for time of war.

The Enlisted Man's Opportunity.

An opportunity is given to the enlisted man to secure a commission in the navy. An experiment station, which shall make New London the centre of marine engineering research in the United States, is projected. The older staff officers are permitted to retire after thirty-five years' service with the rank and honor that is their just due. The detail of naval engineers to the scientific colleges of the land as professors of marine engineering is assured. The loan to the technological institutions of the country of machinery and models which can be spared without detriment to the naval service is also looked out for. The officers of the staff corps are given positive rank and titles.

An examination of the Navy Register of 1861 shows that at the beginning of the civil war about eighty-five sailing and steam ships of war were ready for service. On board these vessels were 667 line officers and 174 naval engineers. The Register of 1865, the official authority upon the subject, shows that there were 2,463 line officers and 2,279 engineers, the strength of the two corps thus being nearly equal.

Unjustifiable Disparity.

Secretary Gideon Welles soon found out that the disparity in numbers between these two corps was unjustifiable, and that the ships would stop running if there were four men to pull the engine-room bell signal and only one man to make the engines go. The engineer, skilled as he was, was unable to keep up with four sets of signals ringing at the same time. The Secretary discovered that the proper ratio of line officers to engineers should be about the same as on merchant steamers.

As the duties and responsibilities of the engineer have increased, he has demanded to be accorded some share of the naval honors and prerogatives. The [illegible] [illegible]/1896. N.Y.